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National Metal Congress

Twenty Thousand Registered; 39 Sessions and Over 100 Technical Papers.

By H. M. ST. JOHN
Associate Editor

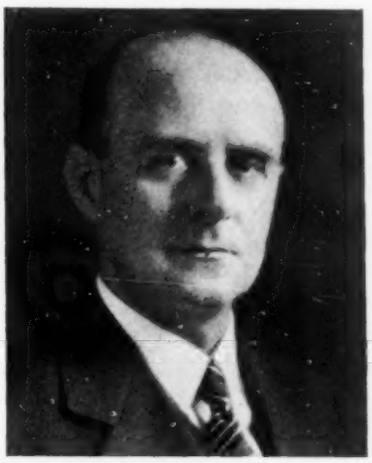
FOR any one individual to describe adequately the Eighteenth Annual National Metal Exposition and Congress is just about equivalent to taking a four-year university course in one summer session. The statistics speak for themselves. The total registration was approximately twenty thousand. Two hundred and fifteen exhibitors occupied 165,000 sq. ft. of floor space. The exposition was larger and more varied than ever before. It seemed that nothing connected in any way with metals, their modern uses and processing, had been neglected.

Sponsored as usual by the American Society for Metals, the following national societies also participated in the Congress: The American Welding Society, the American Society of Mechanical Engineers, the Wire Association and the American Institute of Mining & Metallurgical Engineers. The last named organization was represented by two of its divisions, the Institute of Metals and the Iron & Steel Division, which had a combined registration of more than 400 members. These various societies held a total of 39 sessions, at which more than 100 technical papers were presented. In addition to these there were two lecture courses and a number of special dinners and luncheons at which business was transacted or technical matters were discussed.

At the annual business meeting of the American Society for Metals, **Edgar C. Bain** of the United States Steel Corporation was elected president of the Society, **George B. Waterhouse** of the Massachusetts Institute

E. C. BAIN
President,
American
Society for
Metals

O. W. ELLIS
Trustee,
American
Society for
Metals



of Technology, vice-president. **Owen W. Ellis** of the Ontario Research Foundation and **Ralph L. Wilson** of the Timken Steel & Tube Co. were elected trustees. **William R. Chapin** of E. C. Atkins & Co. was awarded the Sauveur Achievement medal.

Physical Testing

The physical testing of metals was one of the principal subjects of discussion throughout the week. **Professor Harry D. Churchill** of the Case School of Applied Science delivered a series of five lectures, of which the following is a brief table of contents:

Historical Sketch—definition of physical testing; interpretation and use of results; accuracy of results; simulation of service conditions.

Tension and Compression—standard tests; definitions and meaning of the physical constants determined by these tests; changes in method needed for compression tests; effect of speed of testing; effect of size and shape of specimens; types of fracture.

Shear and Bending—methods of determining sheer strengths; relation of shear to tensile and compressive strength; limitation of shear formula to circular sections; bending tests.

Hardness and Impact—types of hardness testing machines and methods of determining hardness; correlation of hardness values obtained by different methods; caution in use of hardness values; absurd hardness specifications; impact testing machines.

Fatigue Testing—types of fatigue tests; S-N diagrams; correlation of results of fatigue tests with other physical constants; preparation of specimens; use of results of fatigue tests in design; impact torsion.

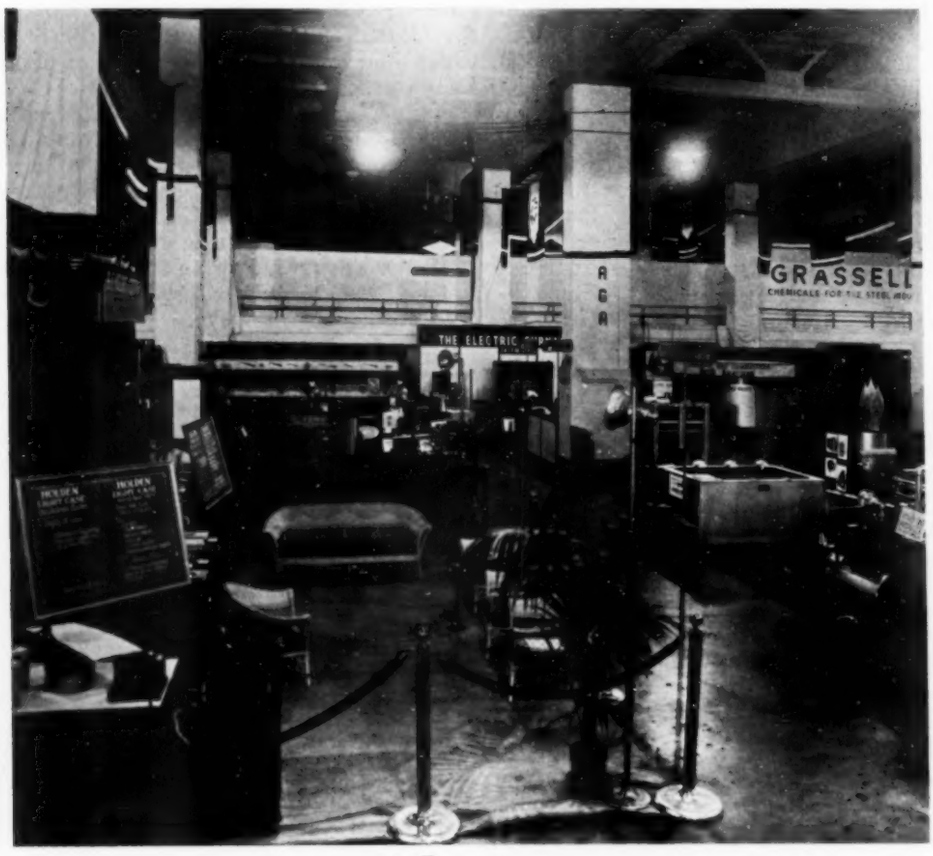
Special Tests—vibration; high and low temperature tests; creep tests; abrasion tests; cupping tests; damping tests; large testing machines and large specimens; proper test for desired results.

This series of lectures, giving information of importance to all branches of metal work, is now available in book form.

The A.I.M.E. devoted two round-table sessions to the subject of physical testing. These were informal with no preprints and no stenographic reports. **"Stress-Strain Relations"** were discussed by **C. H. Gibbons**; the **"Yield-Tensile Ratio"** by **R. L. Templin, Jonathan Jones** and **Rudolph Bernhard**; **"Poisson's Ratio"** by **Robert W. Vose**; **"Fatigue"** by **H. F. Moore**; **"Transverse Notched Bar Test"** by **S. L. Hoyt**; **"Bend Testing"** by **J. R. Townsend** and **Wilber B. Miller.**

Professor Moore's discussion emphasized the importance of fatigue tests when they can be properly interpreted, but brought out clearly the fact that, in many cases, we lack adequate methods for making such tests and may easily be misled by their results. There are many inconsistencies in the published data and many established facts which are difficult to explain.

By several speakers a distinction was drawn between tests intended to develop new knowledge with respect to metals, and tests for purposes of design and acceptance specifications. In commercial tests we must deal with variables in the material itself (which is what we wish to learn from the test) plus variables in the testing equipment, variables in the manner of its use, and variables due to the condition of the test piece. Unless great care is taken, one may easily reach a false conclusion.



A View of the Exhibition Hall

Aging and Precipitation Hardening

Three A.I.M.E. papers were given on the aging and precipitation hardening of metals. **Morris Cohen** in a paper entitled **"Aging Phenomena in a Silver-Rich Copper Alloy"** described a series of experiments to determine whether, in such alloys, hardening could be detected by any means at temperatures below that at which precipitation becomes evident when the alloy is examined under the microscope. His conclusion is that aging takes place in two steps, first, the so-called "knot" formation not visible under the microscope, but detectible by other means, second, visible precipitation accompanied by appreciable hardening.

Under the title, **"Precipitation-Hardening and Double Aging", R. H. Harrington** described experiments with copper-cobalt-beryllium alloys and copper-chromium-beryllium alloys. In the first case, the properties of the alloy were not improved by cold working after the first heat treatment, while with the Cu-Cr-Be alloys investigated, the tensile properties were improved by cold work applied between the two reheats following the solution quench. It is evident that in many precipitation-hardening alloys, double aging makes possible a more accurate control of the desired physical properties.

A paper presented by **William L. Fink** and **Dana W. Smith** was entitled **"Age-Hardening of Aluminum Alloys, II—Aluminum-Magnesium Alloy."** The authors worked with an alloy of high purity containing 10.30 per cent magnesium. They found that, under the microscope, precipitation at the grain boundaries can be observed before a measurable change has taken place in the yield strength and elongation. Important changes in these properties occur when precipitation becomes visible **within** the grains.

Constitution of Alloy Systems

In an A.I.M.E. session on the constitution of alloy systems, **J. C. Mertz** and **C. H. Mathewson** presented a paper on **"The Solid Solubilities of the Elements of the Periodic Sub-group Vb in Copper."** Using the X-ray back-reflection method, phosphorus was found to be soluble in copper 1.7 per cent by weight at 700° C., only 0.6 per cent at 300° C.; arsenic 8 per cent soluble at 680° C., 7.5 per cent at 300° C.; antimony 11.3 per cent soluble at 630° C., 2.1 per cent at 211° C. The solubility of bismuth in copper is believed to be so slight as not to justify investigation.

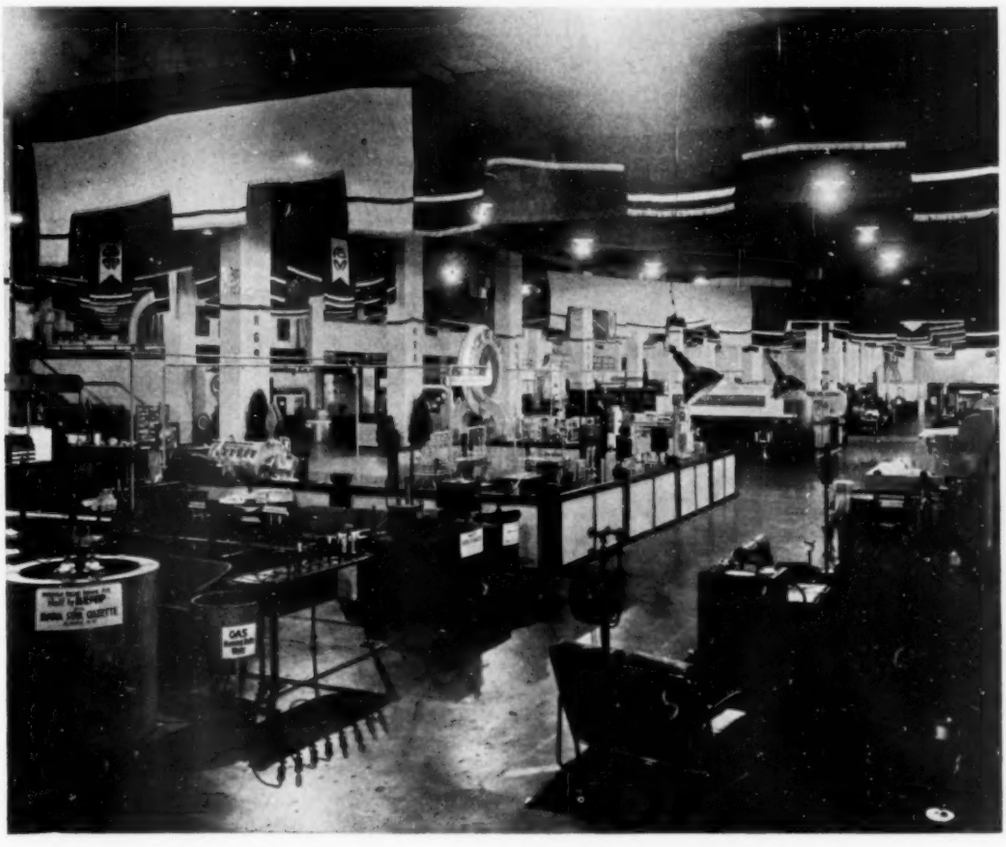
"Notes on Etching and Microscopical Identification of the Phases Present in the Copper-Zinc System" was the title of a paper by **J. L. Rodda,** who describes a method of electrolytic etching by which certain of the phases in this system can be more positively identified than has previously been the case. At current densities above 1.5 amps. per sq. in., in a 17 per cent solution of Cr O_3, gamma is etched, epsilon unattacked; at lower current densities the reverse is true. Eta is etched in both cases.

Other papers presented at this A.I.M.E. session were:

"Equilibrium Relations in the Ni-Sn Systems" by **William Mikulas, Lars Thomassen** and **Clair Upthegrove.**

"Equilibrium Relations in the Al-Mg-Zn System" by **W. Fink** and **L. A. Willey.**

Among the papers on the American Society for Metals program of non-ferrous interest was one on **"The Effect of Titanium on Some Cast Ferrous and Non-Ferrous Metals,"** by **Joseph A. Duma.** Considering titanium as an alloying agent rather than as merely a scavenger, the author includes that its



A Small Part of the 169,000 Square Feet of Exhibit Space

addition to copper-nickel alloys, such as Monel and inverted Monel, is beneficial. The amounts used varied from 0.08 to 0.38 per cent. Machinability and tensile properties were improved without impairment of corrosion resistance.

A paper, **"Extrusion of Metals,"** by **D. K. Crampton,** discusses the history of the extrusion process as applied to non-ferrous metals and describes modern practice. In tube extrusion, linear speeds up to as high as 1,000 ft. per min. are in commercial use.

At various sessions of the American Welding Society and the American Society of Mechanical Engineers, the following papers of interest to the non-ferrous industry were delivered.

"Brazing with Silver Solders," by **R. H. Leach.**

"Technique for Resistance Welding Ferrous and Non-Ferrous Sheet Metals," by **E. I. Larsen.**

"Welding Copper and Its Alloys—A Review of the Literature," by **Ira T. Hook.**

"Resistance Welding of Dissimilar Metals," by **R. T. Gillette.**

"Application of Copper Alloy Welding," by **I. T. Hook.**

"Welding of Monel Metal and Pure Nickel," by **F. A. Flocke** and **J. G. Schoener.**

"Welding the Aluminum Alloys," by **G. O. Hogland.**

Preprints of these papers were not available. They will be published in the transactions of the American Welding Society and of the American Society of Mechanical Engineers.

A most interesting talk was given by **Dr. Albert Sauveur,** dean of American metallurgists at the Annual Banquet of the Iron and Steel Division and the Institute of Metals Division, A.I.M.E. entitled "Metallurgical Reminiscences." Dr. Sauveur traced the growth of metallurgy in the United States and cited a number of internationally outstanding metallurgists.

When and How Silver Solders Are Used*

By R. H. LEACH
Manager, Handy & Harman,
Bridgeport, Conn.

PROBABLY everyone has seen or read about soldering and welding and has wondered what essential difference there is between the two processes to call for their being given separate names. In both processes metal parts are joined by depositing molten metal in the gap between the parts, and permitting the molten metal to solidify. In welding, however, the edges of metal parts are themselves melted; in soldering the metal parts are never melted. The welded joint is created simply by fusion. The soldered joint depends for its strength on other factors, such as adsorption and adhesion.

Silver soldering is no different in principle from soldering with plumber's or tinsmith's solder, which is familiar to everyone. But whereas ordinary solder is made of tin and lead, and melts at about 300 degrees Fahrenheit, silver solder is made of silver and copper, with usually some zinc, and melts at higher temperatures: 1,200 to 1,600 degrees Fahrenheit. The applications of silver solders in industry are discussed in this paper, which also describes up-to-date methods for using the solders.

The advantages of silver solder over other types of solder are strength, resistance to vibration and shock, resistance to corrosion, ease of fabrication. Practically all metals that can be heated without danger to 1,200 degrees Fahrenheit can be silver soldered.

The strongest silver soldered joints are made with the remarkably small gap of one and one-half thousandths of an inch between the parts to be joined. Being so thin, the joint has a neat appearance. In many cases the silver soldered joint is invisible to the naked eye. Mr. Leach cites a test of a silver soldered assemblage of one-inch brass pipe which withstood a water pressure of 4,300 pounds per square inch without failure. Under direct loading one of the brass fittings fractured by the silver soldered joints remained sound.

In addition to its high strength, which makes silver soldering suitable for joining electrical parts or piping that must withstand temperatures up to 850 degrees Fahrenheit, the silver soldered joint has good corrosion resistance. Silver soldering is used especially in chemical equipment in which joints are exposed to severe corrosion by acids or other reagents.

Recent developments in silver soldering have made it extremely easy to produce excellent joints. A method that is often used for pipes requires simply a torch and a ring of silver solder of the same diameter as the pipe. The torch is fed with illuminating gas and air or oxygen. The ring of silver solder is slipped over the pipe to be soldered. The fitting is then slipped over the pipe and the ring. The joint is heated uniformly with the torch until silver solder is seen oozing out at the edge of the joint. Nothing more need be done.

Other developments include dip brazing, in which the joint to be made is dipped in a bath of molten silver solder, and resistance brazing. In the latter method inserts are used as described above, but the heat is supplied electrically rather than by a torch. These and other new developments are rapidly extending the fields of application of the highly efficient process of silver soldering.

* Abstract of paper presented before the seventeenth annual meeting of the American Welding Society, Cleveland, Ohio, Wednesday, Oct. 21, at 9:45 A. M.

Usefulness of Pyrometry in Smelting Works and Foundries

The Uses and Limitations of Heat Measuring Instruments in the Scrap Melting and Alloying Industries.

By EDMUND R. THEWS

Metallurgist,
Berlin-Karlshorst, Germany

IT IS frequently claimed by chemists and metallurgists not directly connected with the scrap melting and alloying industries that these industries are entirely too conservative, not to say primitive, with regards to the introduction of modern methods and to the application of scientific conceptions to the processes and problems in hand. Furnaces and apparatus employed are said to be old fashioned. This criticism usually extends to the control of melting and pouring temperatures of all kinds, and to the application of modern heat measuring instruments such as the optical and thermo-electric pyrometers, thermometers, etc.

Reactions in Metal Refining

One chief difference between conditions obtaining in these industries and the chemical or engineering industries is that the success of correct smelting and melting, or pouring, processes is not always determined by definite temperatures, but that the critical temperatures in question are indefinite and influenced one or the other way by outside factors, which widen the temperature ranges. In a number of such instances the actual critical temperatures can be judged, or estimated, from certain indications, the use of heat measuring instruments being reserved for checking purposes only, while in other cases certain reactions are entirely independent of definite temperatures (although taking place within fixed temperature ranges), such reactions being indicated by characteristic phenomena connected with the metallurgical reaction itself.

The latter remarks refer particularly to processes based upon crystallization and liquation—or segregation reactions, employed for the separation of certain constituents or impurities of metals or alloys. A typical instance of this type is the removal of copper or silver (and occasionally gold) from refined primary or secondary lead. These elements are removed by stirring zinc into the refined metal, the zinc crust holding these impurities segregating at the surface, from where it is removed by skimming. Now, while the various reactions pertaining to this process are more or less bound up with certain narrow temperature ranges, it is difficult to use pyrometers for the determination of the final point, that is to say, that

Tapping a 30-Ton Reverberatory Aluminum Furnace at the Bohn Aluminum Foundry in Detroit

Tapping a reverberatory furnace melting copper base alloy for ingots at H. Kramer & Co., Chicago. A sharp needle bar is driven thru a "V" shaped refractory breast into the furnace, below the surface of the metal.

point (time and temperatures) at which the zinc crust must be removed in order to obtain best results. This point is much more accurately determined with the aid of a small wooden stick, the feel of which on boring or pulling it through the crust accurately indicates the critical point to the experienced furnace man.

Similar conditions prevail in de-copperizing and de-antimonizing white metals, based on the gradual solidification of the zinc-free metal. Copper and a large part of the antimony then segregate at the surface of the bath in form of a crust which grows thicker and harder with decreasing temperatures, although the final point—the removal of the crust—is chiefly determined by the amount of copper and antimony present in the metal as well as by the kind and quantity of the other constituents of the white metal alloys treated. The practical method of estimating the final point in this case is to penetrate the crust with a steel rod, or pin, the feel of the crust and the ease of penetration yielding a rather close indication. It is true that a final segregation is usually necessary to effect perfect removal of the copper—usually in connection with a sulphurizing process, etc.—but the fact remains that the heat measuring device will not help the metallurgist to find, or determine, the exact temperature required, and to fix the critical point in question.

A large number of similar instances could be cited here to prove this point, particularly in connection with the remelting and refining treatment of secondary metals and alloys, where compositions and impurities vary constantly, and where critical points and temperatures are never as uniform as in the treatment of primary metals, or in the production of steel and ferrous alloys.

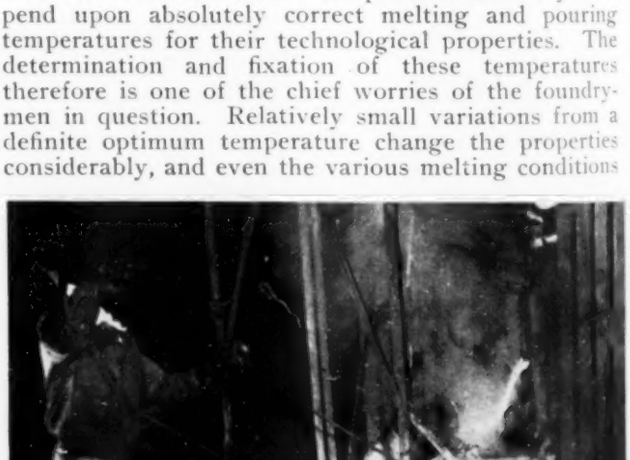
This is not always due to the fact, that the critical temperatures represent a comparatively wide range. There are remelting and refining treatments where the ordinary works pyrometers are not sufficiently delicate to fix the critical temperature as accurately as necessary; that is, where the natural phenomena developed by the reaction itself is more accurate than the heat measuring apparatus.

A very characteristic instance of this type is the removal of excess antimony from tin-rich white metals, which by metallurgical liquation can be reduced to about 3.6 per cent, the final removal of the remaining antimony being effected by other means. This intermediate liquation process is necessary where the original antimony contents exceed 5 or 6 per cent in order to reduce these contents to a point where the final treatment (involving the addition of other metals) becomes economical. If there is a constant supply of large quantities of such white metals, it is advisable to use special reverberatory furnace to carry out liquation, (a process which, by the way, can only be carried out with the aid of a pyrometer). Occasional treatments of this type are effected in large size melting pots, however, and since this liquation process is based on the gradual cooling of the metal, the critical temperature, i.e. the freezing point of the eutectic (360° Fahr.) must be determined exactly and without loss of a minute's time. The high temperature thermometer is useful in determining the approximate nearness of this point, but the final and conclusive indication of the critical moment can be obtained only from the appearance of the surface of the bath. Besides being absolutely clear at the critical point, this appearance (crystalline reactions) changes in exact sequence from the starting temperature of the process down to the critical point: (1) large and coarse crystals; (2) small crystals; (3) large, flat crystal aggregates; (4) sudden stopping of crystal formation, the critical point. So the use of the high temperature thermometer is required only as a check for the foreman who is not always able to watch the liquation for hours at a time. Since works pyrometers or thermometers cannot be maintained accurate to a degree, and since the loss of but a minute's time causes the loss of a large percentage of eutectic by freezing, the natural phenomena above indicated must be used in preference to heat measuring devices.

Reactions in Brass and Bronze Alloying

Entirely different principles prevail in a case of the following type, where pyrometers, while useful as preparatory and auxiliary equipment cannot help in the determination of the critical temperatures.

A considerable number of special brass alloys depend upon absolutely correct melting and pouring temperatures for their technological properties. The determination and fixation of these temperatures therefore is one of the chief worries of the foundrymen in question. Relatively small variations from a definite optimum temperature change the properties considerably, and even the various melting conditions



The tap hole is open. The metal falls into a bottom pour ladle, provided with skimmer bar, which prevents anything but clean metal flowing into the molds.

Three ingots are cast at one time, and approximately 22,000 lbs. of metal is cast per hour. (M. Kramer & Co.)

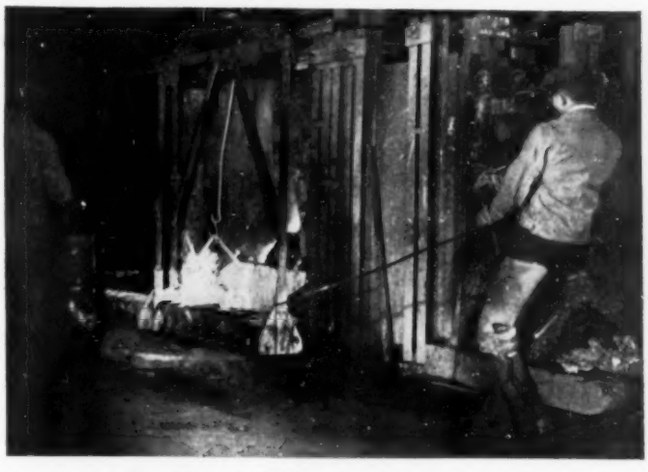
exert a definite influence on pouring temperatures. The author has found that the sensitiveness of these alloys is in many instances due to the influence exerted by melting conditions, such as melting and pouring temperatures, on the zinc contents of these alloys. It is well known, for instance, that within a certain critical range, the rolling properties of brasses can be made and unmade by a difference of 1 or 1½ per cent of zinc. And since the presence of various special metals such as iron, manganese, cobalt, nickel, etc. usually tends to increase this sensitiveness towards changes of composition, even smaller variations of zinc contents will cause definite, and frequently unfavorable, changes of the properties. The guiding rule underlying the metallurgical treatment of these alloys should therefore be to heat the melt as high as possible without causing a definite loss of zinc. It is not possible to sidestep this rule by adding a definite excess of zinc to the mixture to neutralize the loss during melting, because it may be that the actual loss will not always be guided by the intentions of the foundryman, and since excessive zinc in the casting may be as detrimental as a lack of zinc, more exact procedures must be adopted. The author escaped most of the trouble of this type by adding an excess of 0.3 per cent zinc and by heating the mixtures up to a temperature where just the slightest haze of zinc vapor becomes visible. Theoretically, this temperature fluctuates within a range of about 2050° and 2100° Fahrenheit, although the actual temperatures may occasionally rise to 2150° Fahr. For instance, where appreciable quantities of aluminum are present in these brasses, the evolution of zinc vapors is strongly suppressed, the first clouds of vapor appearing at relatively high temperatures.

Experience has shown that in the majority of instances the temperatures indicated by this haze of zinc vapor above the surface of the melt represents the maximum temperature for the alloy in question, the pouring temperature being that at which the haze just disappears, the atmosphere above the metal remaining absolutely clear. Pyrometers are of little use as direct indicators of the exact critical point in these instances, although they can be employed as auxiliary instruments for determining the nearness of the critical point where large quantities of the same alloys are produced, and where the attention of the melter has to be divided among a number of units.

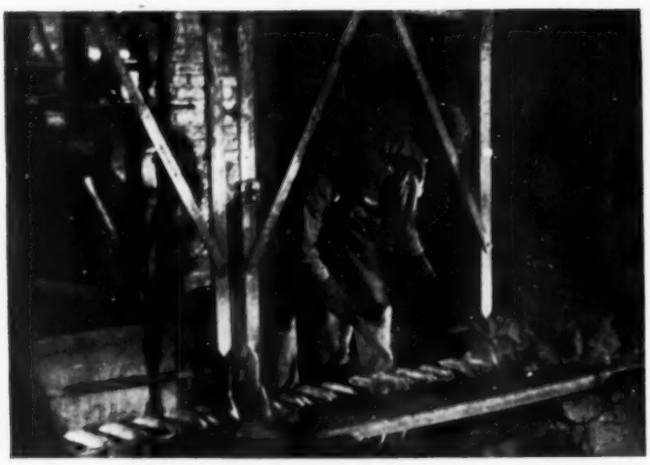
Another type of process in which heat measuring instruments alone are inadequate is that represented by the zinc remelting and refining process. It is well known that the success of this process depends upon the appearance of the surface of the slabs, which must not only be absolutely (blueish) white but which must also exhibit the correct design typical of zinc slabs. It is also known that this design can be obtained only if the zinc is cast at a temperature of 900 to 910° Fahrenheit. Zinc at that temperature is exceedingly corrosive to iron and most other metals so that pyrometers would soon be corroded through; and a temperature of 900° is too low to permit of the use of optical pyrometers. Indeed, this temperature lies exactly on the border line between dark and light heat, and it can therefore be made out almost perfectly by the very faint glow emitted in the dark. If, therefore, the hood is placed over the zinc pot so that no light can enter the interior and if the surface of the metal is observed through a slit of the door, the casting temperature can be observed with an accuracy of ± 10° Fahr. It is necessary, of course, to remove the ashes from part of the surface so as to obtain a clear view of the metal itself. The glow must not be definite, since this would indicate a temperature of about 920° Fahr., which is too high for this purpose, the correct casting temperature being represented by just the slightest indication of glow.

It may be mentioned in this connection that the discoloration of the surfaces of these zinc slabs is not due to overheating, unless this is excessive. The yellow sheen—often partly reddish in color—is almost invariably due to pieces of copper-plated or bronze-plated zinc charged into the pot with the other material. There are doubtlessly, other reasons for this phenomenon, but the author has not been able to fix any other reason but the one indicated. The one unfailing remedy against this coloration is the addition of a very small piece of aluminum to the zinc. It is often possible to eliminate the discoloration of ten tons of zinc by the addition of ¼ pound or less of aluminum.

Apart from these and numerous other similar instances, there are those various "practical" heat indicating reactions used by melters and furnace hands instead of heat measuring instruments. Some melters determine their critical temperatures with the aid of a piece of stiff cardboard or a wooden stick, the peculiar vibrations caused by the evaporation of the water give a rather close indication of the temperature. Others



Each rack of molds, after filling, is taken away from the furnace on an overhead trolley system. The cooling rate of the metal is carefully controlled.



The molds and the ingots at the Kramer plant are air-cooled and then water-cooled. The ingots are dumped into a large vat of water to cool them, for handling purposes

place small scraps of paper onto the metal surface from time to time, watching the paper char and emit smoke, the rapidity of charring and the amount of smoke given off also indicating the temperature of the bath. However, while these tests should not be considered lightly, they can never be grouped with the heat indicating reactions mentioned above, particularly in view of the fact that the subjective position of the person making these tests yields different results in each and every case. Heat indicating phenomena can be considered the equal, or superior, of instruments only if they yield absolute results unaffected by the subjective position of the melters.

Pyrometers vs. Judgment

This applies also to the estimation of temperatures of bronzes, brasses and other copper alloys in foundries, which, it is often claimed yield better results than pyrometers. This claim is frequently justified, indeed, but this is not due to the unerring judging faculties of our old foundrymen but to the ill-advised use of unsuitable pyrometers. It is impossible, of course, to expect results from pyrometers calibrated for lower temperatures or from optical pyrometers as a group, and some types of pyrometers require practically a minute, or so, for a correct reading, the protecting tubes offering sufficient heat isolation to delay the transmission of the full amount of heat for that time.

Nevertheless, the author would rather work with a pyrometer of the latter type constantly than rely upon the judgment of a furnace man unless this man has melted the same kind of alloy under identical working conditions (degree of sunlight or artificial light, angle of light and reflections, condition of metallic surface, etc.) for a sufficiently long time. Wherever these conditions change, the estimates of the melters will change also, unless their judgment is based on a de-facto phenomenon, such as the evolution of zinc, etc. However, conditions will vary even in this latter case, as has been pointed out above, since, for instance, the evolution of zinc is considerably influenced by aluminum, the amount of zinc present in the alloy, etc.

Besides, it is a fact well known to all metallurgists studying this problem carefully, that apart from the outside influences acting on the visual appearance of liquid surfaces, the color and intensity or brilliancy of the light emitted by the various alloys may frequently be changed from within, thus unsettling the judgment of the melters unless they are particularly experienced with one or the other alloy. The yellowish blue light of the pure brass alloys, for instance, will invariably mislead the man who is used to the appearance of the purplish-gold coloration of the tin-rich bronzes at relatively high temperatures. If the latter bronze contains some lead, the purple-gold tinge will gradually assume a blueish-white light, which appears much hotter than the dark tone of pure bronzes of the same temperature. Manganese, iron, and many other constituents also change the light appearance of these alloys, and it is obvious that for this reason alone, heat measuring instruments cannot be replaced by optical estimations for any serious purposes.

Choice of Pyrometers

The matter of selecting suitable heat measuring instruments for the various alloys is not nearly so difficult as is frequently believed. Optical pyrometers can, of course, be employed only where the temperatures of a body are high enough to emit light. A fair minimum temperature for this purpose is about 1600° to 1650° F. It is possible for the experienced or trained eye to read off correctly temperatures of 1500° or even 1400° Fahr., but the general use of optical pyrometers is not absolutely reliable at temperatures below about 1600° Fahr. They can be used for measuring all higher temperatures if the surface of the metal is not covered by slags, ashes, dross, or vapors. This means, that for practically all non-ferrous foundry purposes optical pyrometers cannot be employed if the surface temperature is to be measured. Most alloys of this type discharge vapors at elevated temperatures and the surface of these metals is rarely entirely clean. Measuring the surface temperature of a bath of metal usually gives low results in any case, since the metal is coolest at the surface, so that during the measurement the metal must be stirred, causing corresponding development of fumes.

The same applies to heat measurements of furnace atmospheres, which yields reliable results only if the interior of the furnace is entirely free from vapors. If the measurement is made through the peephole of the furnace door, the instrument must not be aimed at the roof, since this is always hotter than the rest of the furnace, the difference between bottom and roof of the furnace often amounting to several hundred degrees.

An automatic conveyor lifts the ingots and drops them into boxes holding about 5,000 lbs. A sample ingot is removed from each box for analysis

In order to render the optical pyrometers useful for non-ferrous metals, they have been provided with steel pipes which are dipped into the metal, the temperature of the heated walls of these tubes being taken as representing the temperature of the metal. It is obvious that in order to avoid the disadvantages characteristic of these metals (fuming, etc.) these pipes must be closed at the bottom end. The temperatures indicated by the walls of these pipes are slightly lower than the real metal temperatures, a fact due to the cooling effect of the air entering the pipes from above, but this difference can easily be determined by checking the results with a thermo-electric pyrometer. The walls of these dipping pipes must be as thin as possible and of a resistant and stable material. Since a certain amount of corrosion of these pipes cannot be prevented, the material must be such as not to injure the quality of the alloys tested.

The standard heat measuring instruments for the non-ferrous melting and smelting industries are the thermo-electric pyromteers which are used with, or without, protecting tube, replaceable tips, etc. It is not the purpose of this article to describe the principle of thermo-electric pyrometry, but merely to point out the most practical types for the non-ferrous-melting works and foundries.

The first pyrometers developed were constructed with a protecting tube. The chief disadvantage of these instruments is the rapid wear of the tubes and insufficient speed of reaction. The heat of the metal is radiated from the tube walls to the hot junction of the thermo-couple, and it frequently requires 50 to 60 seconds before the indicating instrument comes to a rest. This disadvantage is very serious wherever a large number of measurements must be taken, or where the temperature must be determined quickly.

It is for this reason that most thermo-electric pyrometers now employed on the Continent are without the protecting tube, the thermo-elements being dipped straight into the metal. The heat is indicated practically instantaneously, and while the thermo-couple wires are also exposed to corrosion, the time of exposure is so short that the damage is not nearly so large as that caused by the corrosion of the tubes.

There are a number of intermediate designs intended to combine the protection of the wires afforded by the tubes with the rapid temperature indication of the unprotected wires. In one of these designs the two wires are continued downward into a small hole provided in the tip of the protection tube. The hole fits closely over the hot junction of the two wires, preventing the entrance of metal into the tube. Another construction consists of only one wire within a tube, the wire and tube being soldered together at the tip of the tube. The tube thus forms one element of the couple, and the reading is just about as fast as that of the unprotected wires.

However, both intermediate types have not aroused much interest, at least on the Continent, and the pyrometers with unprotected wires remain the most commonly used thermo-electric pyrometers. The lower sections of the wires are replaceable, of course, although they can be used for a time even after the hot junction has been destroyed by corrosion if the wires have not been shortened too much. This practice should not be encouraged, however, since the readings can be reliable only if the circuit is absolutely complete. Reserve wire sets should always be in stock to replace old sets as soon as the hot junction is destroyed. If no spare parts are on hand, satisfactory readings can for a short time be obtained by cleaning the tips of the wires and pressing them together so as to form an auxiliary junction.

Furnace Man Spare That Instrument!

A matter of concern to all works foremen and supernumber of works instruments have been developed which, while almost as accurate as the laboratory apparatus, will also stand comparatively rough usage. Yet, the abuse to which these instruments are often subjected by the furnace men is more than even works instrument can stand, and the repair bills are therefore rather high where a number of such indicating instruments are used. It is advisable, for this reason to install indicator stations at suitable points, with a number of pyrometers for each indicator. These pyrometers are fitted with long compensating wire connections, so that the range of these stations can be extended to 10 yards or more in all directions. The indicating instruments which are stood on boards or suspended from suitable sockets, are thus protected against undue shocks and blows, and the readings remain reliable for a long time.

Cleaning Stereotype

Q.—We have a problem in our Stereotype Department upon which I would like to have information. We cast semi-circular plates of an alloy of approximately 8% tin, 13% antimony and 79% lead; these stereotypes have to be nickel-plated and our problem is to clean them before the plating process. It is usual practice to use pumice and a stiff brush but this method is slow and cannot be efficient taking into consideration the rough type surface of the plate and the chance of leaving pumice in the plate although it is cleaned carefully before placing in the plating tank.

More recently we have used a solution of salt with a piece of scrap iron in the bottom of the tank; but there must be some more scientific method of cleaning these plates so that they can be nickel-plated without further effort.

A.—Stereotype plates can be efficiently cleaned in an electric cleaner.

Use an electric cleaning compound recommended for the purpose by any of the reliable supply houses.

Use a steel tank and steel anodes at a distance of about 10 to 12 inches from the work and curved to match the surface of the plate.

After electric cleaning, using direct current only, 6 volts, the piece is rinsed, then scrubbed with pumice, rinsed and plated. The scrubbing with pumice after electric cleaning will be less than without the cleaning.—**G. B. Hogaboom, Jr.**

Recommended Practices for Sand Cast Magnesium Alloys

A Report of Nonferrous Division Committee on Recommended Practices* of the American Foundrymen's Association. Part 1.

Preface

THIS is the second in a series of recommended practices being sponsored by the Nonferrous Division of the American Foundrymen's Association, the first being issued in 1934 (Trans. A.F.A., vol. 42, pp. 1-26; see **Metal Industry,** November, 1935, December, 1935, January, 1936, March, 1936 and April, 1936). Others covering the various groups of alloys listed in the Cast Metals Handbook (A.F.A. 1935), Nonferrous Section, are in the process of review and will be published in the near future.

Although the various practices which are treated are recommended by those considered specialists in the various fields, these practices are not intended as specifications. The alloy numbers have no particular significance other than to differentiate alloys in this particular specification. Whenever possible, these numbers are identified with existing alloy specifications.

The publishing of data relative to various alloys and treatment of such alloys by the American Foundrymen's Association, does not insure anyone using such data against liability for infringement of any patents that may now exist or are pending. It should also be understood that the publication of data concerning patented alloys or processes does not constitute a recommendation of any patent or proprietory rights that are involved.

In preparing these recommendations, the Division has attempted to collect, through reliable sources, such information as will be of practical use to foundrymen handling nonferrous alloys.

This report is limited to magnesium alloys and is divided as follows:

A. General Recommendations.
(1) Molding—(a) Sands, (b) Facings, (c) Gates and Risers, (d) Cores.
(2) Melting and Pouring—(a) Melting, (b) Alloying, (c) Scrap Recovery, (d) Dipping and Pouring.
(3) Finishing.
(4) Heat Treatment.
(5) Defects, Their Causes and Prevention.
B. Properties and Applications.
(1) Chemical Control Limits.
(2) Physical Properties.
(3) Conforming Specifications.
(4) Development and Field of Use.

In preparing this report the Committee has been greatly indebted to Dr. J. A. Gann, Dow Chemical Co., Midland, M.ch., for his preparation of the basic material.

Nonferrous Division Committee on Recommended Practices

T. D. Stay, **Chairman**	H. B. Gardner
W. M. Ball, Jr.	H. W. Maack
A. L. Boegehold	R. W. Parsons
L. H. Fawcett	H. J. Rowe
J. A. Gann	T C. Watts

*Many phases of the magnesium foundry practice here described are covered by existing United States patents.

NOTE: This report was presented at a session on Non-Ferrous Castings at the 1936 Convention of A.F.A. in Detroit, Mich.

A. GENERAL RECOMMENDATIONS

1. Molding.

(a) Sands: An open molding sand should be used to offset the lightness of the metal and allow steam and core gases to escape readily. Very satisfactory results are now being obtained from a synthetic sand with A.F.A. permeability of 50 to 60, prepared by adding 4 per cent of bentonite to a silica sand graded to 100 to 150 mesh. A small amount of a "sand addition agent" is mixed with the sand in order to inhibit oxidation of the hot magnesium by steam. The better sand addition agents include sulphur, boric acid, and certain ammonium salts, particularly the fluorides, used singly or as mixtures. The amount used depends upon the agent selected, the condition of the sand, and the thickness of the cast section.

A 75-25 water-glycol mixture is used as the tempering agent. In practice, the glycol is added to the sand and the tempering completed by the addition of the requisite amount of water. Thorough mulling is essential to insure uniform distribution of the bentonite, glycol, and sand addition agent and to improve the strength and plasticity of the sand.

The sand should not be hard-rammed close to the pattern; but as one proceeds away from the pattern, the ramming can be increased to insure safe handling of the mold without danger of drops. Light ramming improves the permeability of the sand and permits its contraction during the solidification and cooling of the castings. This contractability in both molds and cores is necessary to counteract hot-shortness in the alloys and so minimize the danger of shrinkage cracks. The mold should likewise be freely vented to aid in the escape of gases.

(b) Facings: Special facings are seldom used in the magnesium foundry although with heavy castings or sand of relatively low permeability, it is sometimes advantageous to use a facing containing more of the addition agent, to dust the molds with finely powdered sulphur, or to surface dry the mold.

(c) **Gates and Risers:** Although gating practice varies necessarily from casting to casting, there are a number of fundamental principles that must be observed. The metal should, in general, enter the mold cavity at a low point (Fig. 1) with a minimum of splashing or turbulence, since mechanically entrapped gas forms oxide skins in the metal and these,

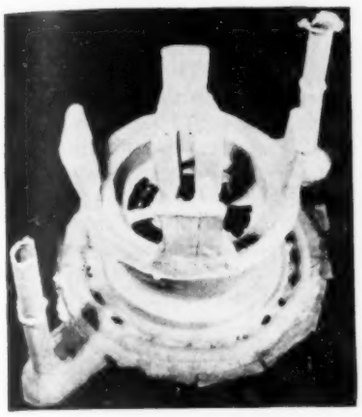


Fig. 1. Casting with Gates and Risers Attached

in turn, increase the viscosity of the metal and retard any subsequent escape of gas. In some cases, however, it is advisable to introduce the metal at the center or top, providing the mold cavity has an incline to break the velocity and is without elevations and depressions that will create a turbulence before the metal reaches the bottom. This procedure often results in a more uniform solidification of the casting, thus helping to eliminate shrinks, cracks, porous sections, and in some cases misruns.

Turbulence, with its resulting evils, is largely overcome through the use of perforated sheet steel skim-gates (Fig. 2) containing eight to twelve perforations per inch. This screen is placed at the bottom of the sprue, and, in large complicated castings, a second screen is sometimes placed in the runner near the gates. These screens choke the flow of metal, thereby assuring a steady feed into the mold cavity, and also trap oxide skins that form on the surface of the metal during the pouring operation. Wedge gates that are wide and shallow and feed from the bottom of a hump or well, likewise aid in the removal of entrapped air and oxide skins but are less frequently used now that skim gates are so generally employed.

A number of finger gates are preferable to fewer large ones as they give a better distribution of heat

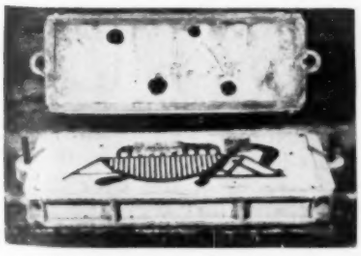


Fig. 2. Open Mold for Magnesium-Alloy Casting; gating methods and skimmers in the gate in place. Turbulence is largely overcome by placing sheet-steel skim gates at bottom of sprue

in the casting and also prevent local overheating of the sand and generation of excess gas and water vapor. Similar objectives call for the location of gates on the thinner sections of the castings. Although the specific heat of the metal is high (0.33 avg. specific heat 70 to 1200° F.), the specific gravity of the metal is low, so that the total heat per unit volume is low. As a result, total gate area and runners should be of generous proportions to insure a free flow of metal. Risers should be large and connected as directly as possible to the section to be fed.

Progressive solidification of the metal should be obtained through the use of risers instead of chills wherever the riser will accomplish the same end, and provided it is located so that it does not introduce trouble in molding and trimming. When chills are used, they may be made from customary materials, such as iron and graphite, although best results are obtained from magnesium alloy chills. They must be clean and dry to avoid blows, and large ones should be perforated to aid in the escape of gas.

(d) Cores: Cores should be made from an open sand containing sulphur, boric acid, and an oil binder. They should be rammed no harder than necessary to insure retaining their shape before baking, and should be well vented. The oil binder should generate a minimum of gas and should permit the core to soften when contacted by molten metal. The cores are baked at 350 to 500° F. for 20 minutes to several hours, depending on the size of the core, after which they are given a graphite-alcohol wash and the alcohol ignited and burned off.

Green sand cores should be used wherever possible for smoothness and economy. They are made from the regular heap used for the production of molds.

2. Melting and Pouring.

(a) Melting: The "Dow Open Flux Pot Melting Practice" is one of the most widely used melting practices for magnesium and its alloys. It is based on the use of a large bath of a fluid flux (Fig. 3) that functions in a dual manner. This flux protects the molten metal from the air and furnace gases by completely enveloping it and, thereby, eliminates the dangers usually associated with prolonged holding of metal

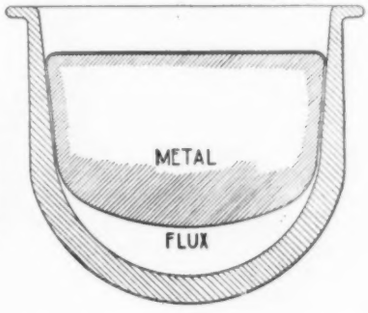


Fig. 3. The main body of flux lies in a pool at the bottom of the pot but a thin film is formed between the metal and the walls of the pot, and across the metal surface

in the molten state and with overheating. It likewise purifies the metal by washing out non-metallic impurities when the metal and flux are intimately mixed. The flux normally used consists of 60 per cent anhydrous magnesium chloride and 40 per cent sodium chloride, and has a specific gravity and surface tension that causes it to float the metal. The main body of flux lies in a pool at the bottom of the pot; but a thin film is formed between the metal and the walls of the pot, and across the top surface of the metal.

Melting pots are made of low carbon cast steel and are good for approximately 1,000 hours of service. Pots holding 300 and 600 lb. of metal respectively are the sizes most generally used and are mounted in gas or oil-fired brick settings.

The charge for the smaller pot consists of 100 to 125 lb. of flux and 300 lb. of metal, added in the order named. The flux has a lower melting point than the metal and soon forms a bath to receive the metal as it melts down. The molten charge is now given a

thorough pudding to bring metal and flux into intimate contact with each other, and thus insure complete removal of oxide and other nonmetallic impurities. Puddling is done with an open-bowl sludge ladle or with a casting ladle described later. The contents of the pot are then allowed to stand quietly for several minutes in order that the impurities may settle from the metal and flux, and form a sludge at the bottom of the pot. This sludge is removed at regular intervals, generally once a day unless very large amounts of scrap metal are melted.

More metal is added as required to replace that removed in the production of castings. Each new charge is washed in flux as already described. The flux can be used repeatedly, but there should always be enough present so that it can be readily brought to the surface of the metal during the puddling operation, and so that the casting ladle can be cleaned in the bath of flux below the metal as explained later. Under normal conditions, one pound of flux is required for each 8 to 12 lb. of metal melted; this ratio depending on whether ingot or scrap is melted.

All material added to a pot of molten metal should be carefully preheated in order that absorbed moisture may be completely driven off. The foundry flux is very hygroscopic and, hence, should be stored in covered containers and should not be added to a pot containing molten metal. This hygroscopicity likewise calls for careful preheating of all equipment, such as ladles, thermocouples, iron molds, and sludge pans.

(b) Alloying: Substantially all magnesium castings are now made from the Mg-Al-Mn and Mg-Al-Mn-Zn groups of alloys. Aluminum and zinc alloy so readily that hardeners and special technique are not required. Manganese alloys more slowly and only to a limited extent. It is generally added in the form of a 90-10 aluminum-manganese hardener. The casting alloys normally contain 0.1 to 0.4 per cent manganese but since this represents approximately the solubility limit, more time and stirring are required than when alloying other metals. A 75 to 80 per cent alloying efficiency for manganese is considered good operating practice. Most of the excess of unalloyed manganese settles to the bottom of the pot, although a few particles of microscopic size remain suspended in the alloy. The alloying ingredients are placed in the ladle and then submerged and gently agitated in the molten magensium, after which the entire charge is thoroughly stirred.

(c) Scrap Recovery: Massive scrap, such as sprues, gates and risers should be free from adhering sand and other contamination. They can be melted the same as ingot, except that the metal should be more thoroughly washed with flux. Metal skim-gates will cause no harm in the pot and can be dipped out with the sludge. In the case of poor quality scrap, it is good practice to use two pots on the counter-current principle, namely, to melt in the one containing the older and dirtier flux and after a preliminary wash to transfer the metal to the casting pot containing clean flux and wash again.

Machine shop scrap, such as shavings, borings, chippings, etc. present a different problem because of the greater ease with which such finely divided metal can be ignited and because of the high ratio of surface oxide to metal. Obviously, this type of scrap should be kept dry and, preferably, free from oil or other cutting compounds. It is melted down at the lowest possible temperature, using plenty of flux and starting with a pot containing some metal in the pasty or semi-molten condition. A shovel full of shavings is then added and quickly stirred into the flux. The heat supply of the pot and the addition of shavings are so controlled that the metal in the pot remains semi-fluid. This low temperature operation practically eliminates any loss due to burning and gives maximum coalesence of the metal. When sufficient shavings have been added to fill the pot, the charge is gently stirred to complete coalesence and the temperature then raised to 1300 to 1350° F. for the regular puddling or washing operations. The pot contents are now allowed to stand quietly for a few minutes to allow the sludge to settle, whereupon, the metal is poured into ingots or transferred to the casting pot. If the melting and purification of scrap is conducted properly, the recovered magnesium alloy is equivalent to virgin metal. Contamination by foreign scrap must be carefully avoided, however, since it often contains copper or nickel, two metals that are very detrimental to magnesium from the standpoint of corrosion resistance.

(d) Dipping and Pouring: A ladle of special design (Fig. 4) must be used to insure proper separation of the metal from flux and the delivery of clean metal to the mold. The essential features of such a ladle are the parting sweep, retaining shield, and underfeed pouring spout. The sweep is used to part the film of flux covering the surface of the metal in the pot and to permit the dipping of clean metal. Oxide films that form on the surface of the metal in the ladle are held back by the retaining shield. The entrance to the underfeed pouring spout is a short distance from the bottom of the pouring ladle and is provided with a flange thus retaining in the ladle any small amount of flux that may have been dipped with the metal.

Fig. 4. Type of Casting Ladle Used for Magnesium Alloys

Prior to pouring, the ladle is preheated and cleaned by washing in the flux underneath the metal at the bottom of the pot. After inverting and draining the ladle, it is rinsed two or three times with metal. This is accomplished by parting and skimming back the flux from a small area on the surface of the metal. The edge of the ladle is now held slightly below the surface, whereupon, clean metal flows into the ladle. Part of this metal is poured through the spout and the balance is poured rapidly out of the back of the ladle. The clean ladle is then filled with metal for casting as previously described in rinsing. If the flux film does not automatically reform as the ladle is lifted from the metal, the exposed surface is protected by sprinkling with powdered flux.

Surface oxidation of the metal in the ladle is minimized by dusting on a mixture of sulphur and ammonium fluoride salts. Any excess metal in the ladle, above that required for the casting, is poured back into the pot near its circumference. The ladle can be used repeatedly until fouled by adhering magnesium oxide, whereupon it is cleaned in flux.

When pouring a mold, the lip of the ladle is held quite close to the mouth of the sprue and the stream of metal is maintained as steady as possible to minimize turbulence and entrapping of gas. When the casting must be poured hot or when a large sprue is required, the surface of the metal in the sprue may start to burn. Such fires, or those caused by accidents such as runouts or spills on the foundry floor, are readily extinguished by covering with regular molding sand.

The lowest possible pouring temperature should always be used as this will insure sounder castings with maximum physical properties and will help reduce melting losses. Temperature control can occur in the pot or in the ladle, depending on whether a single type of casting or a variety of castings requiring different temperatures are being poured. Iron-constantan thermocouples are very satisfactory. These are prepared by welding a constantan wire to the inside tip of a closed thin-walled iron tube. Open couples which expose the constantan to the molten metal should not be used.

3. Finishing

Castings are rough-trimmed to remove sprues, gates, and risers; sand blasted; and given a first inspection prior to heat treatment. Final clean-up generally follows the heat treating operations. Band saws, made from 20-gauge spring temper steel with 4 teeth per inch, are operated at a speed of approximately 4000 ft. per min. Power hack saws should have 10 teeth per in. and hand hack saws 14 teeth per in. Single-cut files are recommended and the type known as "body worker's" files are quite satisfactory for heavy work. Portable electric or pneumatic chippers, rotary files, and grinders are used to good advantage. Medium-hard grinding wheels (K to M for alundum) are recommended. A grain size of approximately 20 is satisfactory for foundry snagging operations, while a grain size of 30 to 46 is best for more accurate work.

Tools used on magnesium alloys should not be used for other metals to avoid the danger of sparks. This is particularly true with grinders due to the inflammability of the powder. Special precautions should, therefore, be taken to see that all skin gates and core wires are removed from the castings before grinding and that the wheels do not touch steel inserts. Operators' clothing should be of smooth cloth with no pockets or cuffs in which dust can collect. The grinding wheels and the floor around them should likewise be kept free from dust, preferably through the use of a suction exhaust system. If proper precautions are observed, the fire risk is small and if ignition should occur, the flame will be confined to a minimum of material. Regular molding sand will quickly extinguish any fire that does start. Graphite, table salt, or cast iron borings should be used in case of fire in the machine shop or around equipment that might be damaged by the abrasiveness of sand.

Welding and soldering of castings are not as common practices in the magnesium foundry as with some other metals, although these operations may be used to repair small surface defects in unstressed sections of certain types of castings. In acetylene welding, the casting should be heated to 600 to 750° F. The filler rod should be of the same general composition as the casting and a flux should be used. (Dow Flux No. 45, Alcoa Flux No. 22, etc.). The completed welds should be thoroughly cleaned in the chrome-pickle solution (see below) to remove any adhering flux.

Castings to be soldered should be thoroughly cleaned by wire-brushing, chipping, or filing so as to present a clean surface to which the solder can bond. They are then preheated to 300 to 400° F. and the solder vigorously puddled with a sharp-pointed steel tool until it has alloyed with the magnesium. Suitable soldering materials include 90 per cent cadmium —10 per cent zinc or 60 per cent cadmium—30 per cent zinc—10 per cent tin. The former is less brittle but requires a somewhat higher temperature.

Painting is the most practical surface finish for magnesium castings where appearance and protection are important. Chemical finishes have been developed but they are more important as preliminary treatments for painting than as decorative coatings.

The successful painting of magnesium alloy castings offers no unusual difficulties where approved materials are used and good painting practice is observed. Oxide films and dirt are generally removed mechanically by sandblasting or wire brushing. Oil and grease are removed by washing with a solvent, such as carbon tetrachloride or gasoline, or are removed by treatment in hot alkaline cleaners. Cleaned castings are then given the chrome-pickle treatment. This consists of a ½ to 2-minute dip in an aqueous solution containing 1.5 lb. of sodium bichromate and 1.5 pints of concentrated nitric acid per gallon of solution. This bath becomes depleted on use but its efficiency can be restored by proper additions of bichromate and acid. The bath should be discarded after it has been rejuvenated four or five times. Upon removal from this bath, the castings are allowed to drain for a few seconds and then thoroughly washed in hot water. This treatment improves the corrosion resistance of the metal and gives an excellent "tooth" which increases the adhesion of subsequent paint coatings.

The selection of the primer is very important in view of the fact that all representatives of a given class of paints do not show the same service performance. Vehicles with maximum adhesion and maximum imperviousness to water should be selected where service conditions are severe. Baking primers and finishes have excellent adhesion and are, therefore, recommended for small castings or wherever they can be applied. Zinc chromate primers meeting Navy Specification P-27 should be used on large castings in service near salt water or continuous moist air. The latter constitute the best all around primers and should be used where the type of service is unknown. The choice of surfacer and finish coats is likewise important although perhaps not exacting. A good quality oil paint or enamel is satisfactory for interior work while full synthetic and oil-base synthetic enamels represent the better class of products for outdoor service or near the sea coast.

4. Heat Treatment

Most of the magnesium sand casting alloys now being used commercially are amenable to heat treatment with marked improvements in mechanical properties. Both the solution and the precipitation methods are used, depending on properties required. The solution heat treatment (H.T.) of the Mg-Al-Mn alloys consists of 16 hours heating at 775° F. followed by a quench. It increases the tensile strength, toughness, and percentage elongation of the alloys. The smaller percentage aluminum in the

Mg-Al-Mn-Zn alloys permits the use of a lower temperature and this is desirable to avoid the hot-short temperature zone occasioned by the presence of zinc.

The aging or precipitation heat treatment (H.T.A.) is given to the solution heat treated material and is substantially complete after 16 hours at 350° F. This treatment raises the yield strength and hardness of the alloys with a lowering of ductility and toughness. Properties intermediate between those of the solution heat treated and the fully aged conditions can be obtained by giving the alloy a partial or short-time precipitation heat treatment. This partial aging is not used extensively, however, because of the practical difficulties encountered with furnace charges consisting of various sized castings with both thick and thin sections.

Accurate temperature control is very important, particularly with the solution heat treatment which is carried out at a temperature close to the softening point of the alloy. Electrically heated ovens equipped with automatic temperature control and fans that give reversals in direction of the circulating atmosphere insure the proper temperature regulation.

5. Defects, Their Causes and Prevention

Most of the troubles encountered in the magnesium foundry are similar in nature and remedy to the corresponding difficulties met in the production of castings from other types of alloys. Where differences do exist, they can usually be traced directly or indirectly to the lightness and chemical reactivity of magnesium.

Dross in castings is usually due to the pouring of dirty metal (incomplete washing with flux); to improper or insufficient skimming action in the gates; to the use of few large rather than numerous small gates; and to high pouring temperatures.

Burned spots are generally due to insufficient sand addition agent or to wet and hard rammed sand. Such troubles are overcome by the addition of more protective agent to the heap or facing; by dusting sulphur on the surface of the mold; by surface drying the mold; or by the use of smaller gates so as to give a more uniform distribution of heat in the mold.

Blow-holes are usually caused by dirty metal, improper gating, or improperly prepared sand. Dirty metal is more viscous than clean metal and so retards the escape of entrapped gas. The gates should, therefore, be so arranged that the metal enters the mold with a minimum of turbulence and mechanical entrapping of gas. Hard rammed molds, particularly from wet sand, and wet or dirty chills may result in surface blows sometimes mistaken for shrinks.

Pin-hole porosity is closely associated with other troubles, such as dross, burns, and blows and is probably due to somewhat similar causes. The more important factors that aid in its elimination are the pouring of clean metal from a ladle held close to the mouth of the sprue; the use of properly tempered sand containing sufficient protective agent; and proper gating for maximum skimming and minimum agitation of the metal. Tilting and venting of molds, particularly for flat castings, often aids in the elimination of this defect.

Shrinks may appear as surface depressions or as porous spots. Shrinkage cavities seldom occur except in the case of very heavy sections. Surface shrinks can generally be eliminated by the use and proper placement of risers and chills; by a change in gating to permit a lower casting temperature and a more uniform feeding and solidification of the casting. Blows caused by the use of wet or dirty chills or by hard rammed molds may be readily mistaken for surface shrinks.

Porous spots are those sections where shrinkage has resulted in a multitude of small, often microscopic, cracks rather than in the formation of a few large cracks or pronounced surface shrinks. These defects are aggravated by oxidation nitridation of the spongy metal, particularly during heat treating operations. These porous spots often penetrate a considerable distance toward the interior of the casting and appear as gray colored spots on fractured surfaces.

This Report will be concluded in an early issue. —Ed.

Melting and Pouring of Brass and Bronze*

All foundrymen realize the importance of gating and molding to the manufacture of good castings. But granted that these two conditions have been adjusted to a satisfactory degree, there is still the question of melting and pouring procedure to consider.

We have studied the standard practice for crucible melting in various foundries throughout the country, and below there is given the consensus of opinion as to the best practice used.

1. Use a couple of handfuls of dry charcoal (coarse preferred) at bottom of pot. Place charge on same and melt.

2. After melting, skim, and then cool down to correct pouring temperature by adding gates or sprues.

3. Add from 1 to 2 ozs. of 15% phosphor copper per 100 lb. of metal melted. Push slag back and place phosphor copper on the clean metal surface; otherwise slag will be deoxidized or absorb the phosphorus. Stir thoroughly and skim again (phosphor copper in any form will do, although shot is preferable).

4. Pour metal at the coldest temperature possible; in other words, just hot enough to avoid misruns and internal shrinkage. The metal should be taken out of the furnace at a slightly higher temperature than desired for actual casting and chilled down to proper pouring temperature, for this permits the entrapped gases to escape and any slag formed during melting will rise to surface of pot and it may be skimmed off.

5. Push slag back from the lip of crucible before pouring each mold. Do this before crucible is tilted over the mold in which metal is to be poured. Particles of slag will thus be prevented from falling into the open sprue, with resulting "cold shots" or "dirty castings."

6. Keep sprue filled at all times during pouring. Do not pour intermittently, as air may be drawn into the sprue, resulting in "gassy" castings and occasional "cold shots."

*From Kramer Alloy News.

The Effect of The Addition of Lead on the Endurance Limit of a Certain Tin-Base Bearing Alloy

The Addition of 4 Per Cent of Lead Has Little Effect on the Endurance Properties of a Tin-Base Bearing Alloy (80 per cent Tin, 15 per cent Antimony, 5 per cent Copper). A Particular Form of Bearing Failure Occurs After the Alloy has Been in Service a Long Time. Some Explanation for this Failure.*

By JOHN N. KENYON

Testing Engineer, Civil Engineering Testing Laboratories, Columbia University, New York City.

AMERICAN practice strictly limits the lead content of tin-base babbitt metals because of the supposed softening and embrittling effects. On the other hand, European practice often permits the addition of small amounts of lead, even when these alloys are to be subjected to severe service such as in Diesel engine crankshaft bearings. The main bearings of American automobile engines, for instance, are lined with tin-base babbitt metal about 0.031 in. (1/32 in.) thick, and the lining may absorb lead from the "tinning" operation. This absorption of lead may justify, to some extent, a low lead tolerance in the standard specifications. It is yet to be determined, however, whether lead should be considered as an injurious impurity or a valuable alloying element, and it is hoped that this study may throw some light on the question.

A Brief Survey of Other Recent Findings

Ellis and Karelitz (1928-1930) found that lead adds something to the mechanical strength of a tin-base bearing alloy and has an important effect on the microstructure. It was suggested that "the microstructural changes occasioned by lead tend to confirm the current opinions regarding its embrittling action"[2]. They found that "wiping" may occur at temperatures of 170 to 180 C. due to the presence of a tin-lead eutectic even though the lead content is within the tolerance set by American practice (0.34 per cent)[3].

Cowan (1928) found some tin-base bearing alloys "to contain shrinkage cavities when small percentages of lead are present, but to be practically free from similar cavities with no lead content"[1].

Kenyon (1933) found that the addition of 3 to 4 per cent of lead to some tin-base bearing alloys increased the hardness of these materials for temperatures up to 100 C. No important falling off in hardness was found for temperatures up to the melting point of the tin-lead eutectic (183 C.) but at higher temperatures the alloys containing over 2 per cent of lead showed a tendency to crumble under the Brinell load[4].

MacNaughtan (1934) discusses the general question of white bearing metal service failures and draws the following conclusion:

"Although failure by pounding is occasionally important, the outstanding difficulty experienced in current severe conditions, particularly internal-combustion engines, is a peculiar form of fatigue cracking. After a period of service under pulsating stress and high temperature, numbers of fine cracks appear on the surface of the bearing and spread in all directions to form a network similar in appearance to a tesselated pavement." MacNaughtan continues: "A considerable amount of data has been obtained (on white metals) with respect to wear resistance, friction under test conditions in bearings, and such physical properties as are revealed by determinations of Brinell

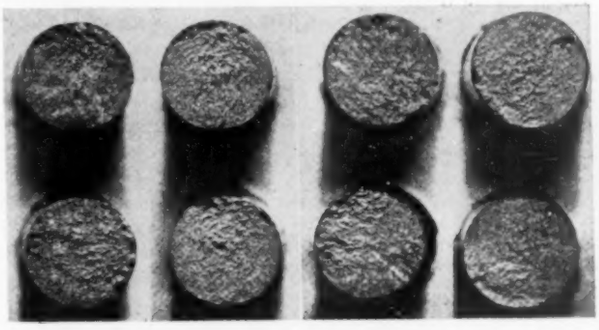


Fig. 1. Fig. 2.

Fig. 1.—Fatigue fractures obtained in sound metal Fig. 2.—Fatigue fractures due to defects. The lower left fracture was caused by a microscopic surface inclusion; the other three are attributable to gas cavities.

* From a Paper read at the Meeting of the American Society for Testing Materials in Atlantic City, June 29-July 3.

[1] W. A. Cowan, "Minute Shrinkage Cavities in Some Cast Alloys of Heterogeneous Structure," **Journal,** Inst. Metals, Vol. 39, No. 1, p. 53 (1928).

[2] O. W. Ellis and G. B. Karelitz, "A Study of Tin-Base Bearing Metals," **Transactions,** Am. Soc. Mechanical Engrs., Vol. 49-50, Part II, p. MSP-50-11 (1927-1928)

[3] O. W. Ellis and G. B. Karelitz, "A Study of Tin-Base Bearing Alloys," **Transactions,** Am. Soc. Mechanical Engrs., Vol. 52, Part II, p. MSP-52-7 (1930).

[4] J. N. Kenyon, "The Effect of the Addition of Lead on the Hardness of Certain Tin-Base Bearing Alloys at Elevated Temperatures," **Proceedings,** Am. Soc. Testing Mats., Vol. 33, Part II, p. 430, (1933).

hardness, proportional limit in compression, etc. There is, however, almost an entire absence of information concerning fatigue properties"[5].

Method of Test

A babbitt metal (80 per cent tin, 15 per cent antimony, 5 per cent copper) was prepared from commercially pure materials and to one-half of this alloy 4 per cent of lead was added. These two batches of metal were then cast in triangular-shaped solder molds (⅝ in. deep and ⅞ in. wide at top) so as to avoid any chance of segregation. The material was carefully remelted and chill cast at 700 F. (370 C.) into ½-in. diameter rods about 5 in. long. These rods

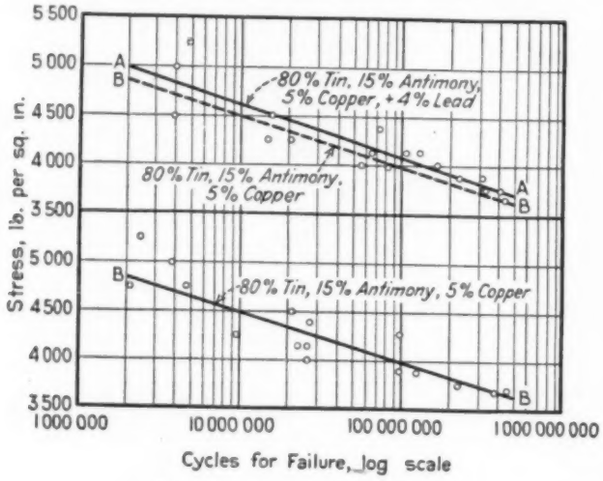


Fig. 3. Summary of Results

were annealed at 212 F. (100 C.) for 12 hr. to remove casting stresses and were then machined into standard R. R. Moore fatigue coupons. The test specimens were given as good a polish as possible on the lathe and a final longitudinal polish, using No. 000 Hubert paper. The fatigue machines were operated at a speed of 3750 r.p.m., with bearing temperatures of about 140 F. (60 C.). The temperature assumed by the test coupon was very nearly this value.

Discussion of Results

The appearance of the fatigue fractures is shown in Figs. 1 and 2. The fractures are similar to fatigue breaks obtained on the harder "elastic" materials wherein a smooth crack spreads over a large section of the specimen before final fracture. Careful measurements of the broken test coupons showed no evidence of "creep," and it is believed that rate of loading did not affect results.

Figure 1 shows the appearance of fractures obtained in sound metal and Fig. 2 the appearance of fractures attributable to defects. Three of these breaks were caused by gas cavities, and the fourth by a microscopic surface inclusion not clearly discernible in the photograph. The defective specimens failed shortly after being placed in the fatigue machine.

Figure 3 is a summary of the results of the tests. The addition of lead appears to have little effect on the endurance properties of the alloy except possibly to improve it. There is nothing in the results to justify the current opinion that lead has an embrittling effect on the alloy[2]. The endurance properties of the alloy do not appear to be impaired by the addition of lead as would be expected if minute shrinkage cavities occurred[1].

The trend of the graphs would seem to indicate that there is no **definite** endurance limit, and ultimate failure may occur at lower stresses after a considerably greater number of repetitions. To some extent this deduction would explain the "peculiar form of fatigue cracking" mentioned by MacNaughtan[5].

A period of three months is required for subjecting one test coupon to 500,000,000 stress reversals, and time did not permit carrying the investigation any further.

Acknowledgments.—Appreciation is due Prof. William Campbell and Prof. James K. Finch for their encouragement.

[5]D. J. MacNaughtan, "The Improvement of White Bearing Metals for Severe Service," **Journal**, Inst., Metals, Vol. 55, No. 2, p 33 (1934).

"Glass Finish" on Gears

Q.—In making high speed turbine gears, while they are working most beautifully as far as efficiency is concerned, yet we have not been able to get a "glass" finish on them through our lapping methods. What do you know about such lapping as applicable to 40 to 50 carbon molybdenum steel and on gears where the polish can only be applied through a lapping compound operating between a pinion and a gear?

A.—There are two ways of giving a super-finish to gear teeth, namely burnishing and lapping. These are both smoothing in character, but are not a corrective for any errors of the tooth curves and dimensions. The gear cutting should be a smooth job in itself, and the tooth form and dimensions should be correctly generated by the cutting machine.

The best burnishing is attained by the use of a specially designed machine, and using three hardened steel gears reciprocating in mesh with the given gear. The machine gears must have ground and perfectly smooth surfaces, and the teeth must be of the same pitch and angle as the involute gear being burnished. A lubricant of mixed light machine oil and kerosene or something similar, is beneficial. A floating pressure is applied by weights or by a water column to the contact surfaces.

Lapping by the machine method uses accurately cut gray cast iron gears for laps and a flooded abrasive over the surfaces. For treating spur gears, the laps are internal gears having tooth curves that fit the involutes on the treated gear. This lap has a larger rubbing area than spur gear laps. The abrasive should be very fine and the carrier for the abasive should be thick enough to hold it in suspension. Keep the material well stirred anyhow. The floating pressure should be moderate. In case your equipment is correct try a finer abrasive of the carborundum type and a heavier oil than for burnishing.

—W. B. Francis.

The Melting of Platinum

Melting Small Lots; Filings; Defective Metal; Difficulties; Large Melts; Platinum Sponge; Platinum Alloys; The Electric Furnace; The Oxygen Torch; Other Accessories; Crucibles and Refractories. Part 1.

By C. M. HOKE
Consulting Chemist, The Jewelers Technical Advice Company, New York, N. Y.

PLATINUM is again in the public eye, because of renewed demands in many markets, and it is fitting that we should again* consider the methods of melting it and its alloys. It is being melted every day, not only in the refineries where it is purified and sold, but also in a host of jewelry shops and dental laboratories where it is being worked. Methods of handling both large and small quantities will be described, and the equipment used will be illustrated.

The melting point of platinum is so high—3191° F. or 1755° C.—that furnaces suitable for melting gold or silver are not adequate. City gas with oxygen, or hydrogen with oxygen, is commonly used, and the electric furnace is used in some special cases. The problem of choosing proper refractories has commanded a good deal of attention, as we shall see later; many kinds of crucibles have been used, the most popular being those made of lime, or of a composition not unlike that of the old-fashioned sand-clay crucibles used in melting gold. Since platinum does not oxidize even at its melting point, no flux is required.

Melting Small Lots of Platinum Scrap

In a jewelry shop that makes platinum jewelry, clean scrap may be melted five or six times a day. City gas, with commercial oxygen from a cylinder, is the fuel most commonly used. When city gas of proper composition or pressure is lacking, a cylinder of hydrogen may take its place. Acetylene with oxygen provides enough heat for the purpose, indeed, more than enough; but because of its tendency to form a brittle carbide, as well as because it may melt the crucible and volatilize some of its contents, the oxy-acetylene flame is not often used in this work.

Fig. 1. Melting a Small or Medium Sized Melt

The sketch shows the ordinary arrangement of equipment. A so-called "one inch" gas supply pipe, with a "⅜ inch" service cock, will furnish enough gas for the average jewelry shop. The torch shown is suitable for melts up to 100 ounces; it is only one of a series; a small shop might prefer a smaller model, though in general it pays to purchase a large torch, capable of handling the largest probable requirements, as it will be equally usable on small lots, and quicker and more economical in operation at all times.

We shall describe first the melting of a small quantity, 100 pennyweight or less, since that is the size melt most frequently made. A melt of this size is usually made in a "sand" crucible wide at the base and low on one side, as shown in the sketch. Usually this crucible is set inside another larger crucible, or perhaps into a cavity carved out of an insulating brick, or the like, to conserve heat and protect the table beneath.

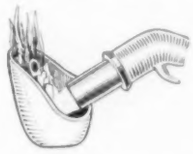


Fig. 2. Angle at Which Torch Should be Held

The sheet-iron screen serves merely to prevent any scattering of small bits of the precious metal. A covered hood or canopy, such as is often used in annealing, is not suitable for this purpose as it throws the heat back into the worker's face. Under the screen a sheet of asbestos board protects the table.

The rest of the equipment is shown in the sketch —tongs, hammer, anvil, dark spectacles, the torch with its hose, and the oxygen cylinder with its regulator and gauges. Since the melting of clean platinum produces no unpleasant fumes or smoke, no flue is needed, and the entire outfit is portable.

The beginner is advised to learn how to melt scrap or clippings before attempting to melt filings.

The clippings are stacked up against the high side of the crucible. First the worker acquaints himself with the torch, turning on the gas and lighting it, then slowly admitting oxygen until a clear blue flame, with a noticeable roar, is obtained. If the crucible is new, he anneals it lightly by passing a flame over it to drive out moisture. The flame is then turned directly upon the metal, and if the flame is right, the edges of the metal will melt and run within a few seconds. A slightly oxidizing flame is used; with too little oxygen the flame is yellow and sooty, not hot enough to melt platinum but capable of embrittling it through the formation of a carbide. If too much oxygen is used, the flame is apt to blow out, is too cool to melt platinum, and is also capable of embrittling it through causing adsorption of oxygen.

Copyright, 1936, by C. M. Hoke.

* In September and November 1916 METAL INDUSTRY published an article with this same title by the same author. The present article brings the subject up to date.

A few minutes' practice is usually enough to enable even the beginner to get a satisfactory flame. The metal soon flows down and runs into a globule. The torch should be held at an angle—not straight up-and-down—playing upon the bottom of the crucible, and slanted so that the products of combustion are not reflected directly back upon the torch nozzle. Nor

Fig. 3. A modern oxy-gas torch

should the torch be held too close to the molten metal, otherwise it will itself melt.

Within a very few minutes 100 pennyweight of platinum will be molten; three or four minutes is about average time with the torch shown. If the metal does not melt promptly, it is because the flame is not right; perhaps the gas volume is inadequate; or the oxygen volume is too high or too low. The next task is to mix the metal thoroughly by moving the flame around over it so as to revolve the molten metal; in that way any unmelted lumps will be liquified. The metal should run around in the crucible like a little pool of mercury.

The worker next removes the flame and shifts his dark spectacles up onto his forehead. Then, with a wet tongs, he pushes the button (which by this time has solidified) out of the crucible, and places it bottom upward on a piece of clean refractory, for example the bottom of an inverted crucible. The button will be rough, from its contact with the crucible, and will need smoothing. The worker promptly replaces his spectacles and turns the flame on this rough surface for a few seconds, long enough for it to run smooth, while any beads of sand from the crucible will slip to the edge. This process, usually called "sweating" or "flushing," should always be carried out on a highly refractory surface; a silica insulating brick, for instance, should not be used here, as it will soften under the flame and the button will sink into it.

While the button is still white hot, it should be hammered hard on the anvil and shaped into a square block or bar. This hammering does more than shape the metal, however; it proves its quality, for if impure it will split under the hammer. Also, it makes the metal dense and hard, so that it keeps its polish when made up into jewelry. The hammering sometimes leaves grooves in the metal which are too deep to be obliterated by the rolls; these may be easily removed by sweating. Sometimes the hot metal is placed under a drop-hammer in a die; this gives a dense and firm texture with little effort on the part of the workman.

Finally the metal is cooled in water and drawn or rolled to the thickness desired. Comparatively little annealing is called for, and it is desirable to roll hard.

Melting Platinum Filings

It takes longer to melt 100 pennyweight of filings than 100 pennyweight of clippings. For one thing, a gentler flame must be used, especially at first, or the small filings will be blown about. In addition, the many facets and angles reflect and radiate the heat and make the process slower. For these reasons the beginner is advised to become familiar with the torch and learn how to handle clippings, before melting filings. Aside from these details, it is no more difficult to melt clean filings than clippings.

Dirty filings are another story, as will be brought out later. Jewelers are apt to use on platinum the same methods that they have been using on gold. Now it is easy to remove certain impurities from gold filings by melting and remelting them, but it is not easy to refine platinum filings in the same way. It is much easier to remove the dirt before melting them; and if this cleaning is properly done, the melting is easy and successful.

As in the case of scrap, the filings are piled up against the high side of a sand crucible. Most workers prefer to handle small lots—50 pennyweight or less at a time. When they have more than that on hand, they divide it up into several small lots, and obtain several small buttons, then melt the buttons together into one large button.

A gentle flame is turned on at first, with enough gas and oxygen to give the proper temperature, but without blowing or noise. This is directed at the bottom of the stack of filings, and slowly brought toward them. Soon the outer layer of filings will melt and run together. With that the flame is brought closer, and its pressure increased gradually, while the worker takes care to keep the bottom of the stack hot.

From here on the method is practically the same as for clippings; the metal runs down into the bottom of the crucible, the flame is moved around over it to be sure that all parts are molten, etc. Finally the button is lifted out and sweated as before, and hammered while hot.

This is another instance where platinum differs from gold; gold is not hammered when hot, but platinum is better the hotter it is when hammered. When a crucible full of molten gold cracks, the result is often disastrous; the gold seems to find the smallest crack and go through it immediately. But molten platinum acts quite differently; its surface tension is so high that the metal rounds up like a drop of mercury, and will remain on top of even a sizeable aperture. This high surface tension is a characteristic of pure or clean metal; when impurities are present the drop is flatter and tends to spread out as it cools.

A melt of 100 pennyweight of clean filings should not take more than ten minutes; a skilled worker will accomplish it in much less time. But filings so frequently contain dirt that it is customary to melt the button over again.

Cleaning Platinum Filings

The dirt in filings, which is the cause of most of whatever difficulties come in melting them, may be of several kinds. They are brushed up from a jeweler's work-bench; therefore they will contain particles of wood, steel from the files, dust, hair from the brush, solder, probably shellac, charcoal, paper, tobacco, emery, plaster-of-paris borax, and other trash. If gold jewelry is being made in the same room, the platinum filings are practically sure to

contain gold also, even though efforts have been made to keep the two separate.

When the worker is ready to melt his filings, he usually takes out the steel (as far as possible) with a magnet, and probably he burns out the paper, wood, etc., by heating the filings in a frying pan. This converts some of the trash into cinders. If gold is present it must be removed by some chemical refining method, which at the same time will take out base metals; this is being done regularly in many factories.

If gold is absent, a washing with nitric acid may be enough; this does not dissolve cinders; but in rinsing off the acid most of the cinders are flushed out also. Setters' filings, which contain much shellac, are often boiled in caustic soda instead of being burned in the frying pan; this dissolves shellac, also grease and many other kinds of organic dirt. Sand and emery, if present in only small amounts, cause no trouble, as they melt into a sort of slag that can be swept to one side by the flame. But if present in large amount, they can be very troublesome, forming a thick coating over the filings and making the melter's task slow and unpleasant. Sand can be dissolved out with hydrofluoric acid, but true emery (aluminum oxide) is practically insoluble. However, there are other excellent abrasives on the market, some of which yield to chemical treatment, and are therefore recommended for use with platinum.

Defective Metal

Slovenly refining is the cause of much defective metal. It must be remembered that platinum solder is not platinum, and it should be removed the same as any other foreign matter. Dirt shows itself by a smoke that rises from the metal during and after melting. Sometimes in addition the surface of the button will be dark, or pitted, or warty. Or, as we said before, the button will flatten out as it cools, instead of solidifying in a rounded globule smooth and bright of surface. A button that smokes or has a bad surface should be hammered with care, as it is apt to shatter under the hammer.

Such buttons can sometimes be "saved" by remelting. They should be rolled or hammered as thin as possible, cut up, and the pieces stood on edge in a clean crucible, and remelted as if they were clippings. If the flame is allowed to play on the molten metal for a few seconds, the dirt may burn out. There is always a small loss of platinum in this, and some loss of iridium. It is plain that this procedure is not to be recommended; it is much better and easier in the end to clean the filings carefully before melting them.

Incomplete or careless refining will leave gold, silver chloride, and probably copper in the material; perhaps other things as well. Gold shows itself by a bronze or purplish stain on the crucible; silver chloride leaves a darker stain and gives a characteristic smell; copper shows itself by coloring the flame green during the melting. If a crucible shows noticeable darkening after a melt, it should not be used again.

Difficulties Not Due to Impurities

Sometimes perfectly clean platinum will yield a defective button when rolled or annealed; it may be pitted, or brittle, or "double." All of these faults can be corrected by one remelting, and they do not occur after the worker has acquired a little experience.

If a button is brittle, and the color of the crucible shows that the metal was clean, the chances are that an improper flame was used. Perhaps there was too much oxygen; this gives a white, warty button. Or perhaps the worker let a smoky flame play on the metal after it was molten; this gives a warty button with a dark grey color.

Pits in the surface appear when the button is not properly sweated; they come from beads of sand from the crucible.

"Double" platinum is caused in this way: part of the metal melts and runs down into the bottom of the crucible, where it cools. Later more metal melts and runs down over it, and the two layers do not flow together. Subsequently, when the button is rolled, a blister will show where the two layers failed to join. If a worker suspects "doubles" he will anneal the metal after rolling, as this makes the doubles more conspicuous. The way to avoid this is simply to keep the bottom of the crucible hot all the time, and to be sure that the metal is truly molten before it is allowed to cool.

The remedy for all these imperfections—brittleness, warts, pits, and doubles, is simply a remelting.

This article will be concluded in an early issue.—Ed.

Refining Silver Amalgam

Q.—I am interested in refining scrap amalgamated silver as used by dentists, along with Sterling silver. I want to do this electrolytically if possible. Can you give me any information.

A.—The Bureau of Mines, U. S. Dept. of the Interior, Washington, D. C., has published a pamphlet that will be useful to you. It is Information Circular I.C.6787, entitled "Placer Mining in the Western United States, Part II," by Gardner & Johnson. It was written originally for the use of miners and prospectors handling gold ore in small quantities, but some of the facts apply equally well to dental amalgams.

Thus, it describes fully, with illustrations, the way to distill mercury from precious metal amalgams in such a way as to avoid danger to the worker and to save all value.

These amalgams contain mercury, silver, tin, zinc, and other base metals. After the mercury has been distilled off (as described in the pamphlet above) a crust of impure silver remains. This impure silver is usually of small value, and in most cases its recovery is difficult and expensive. The shop that handles only a few pounds of this per day would do well to sell it, rather than to attempt to refine it at home, as it is one of the less profitable branches of precious metal recovery.

Electrolytic refining of silver is carried on profitably by only the largest plants. You will find good descriptions of the various methods in the following books: Electroplating and Electrorefining by Watt & Philip, published by D. Van Nostrand Co., N. Y.—Metallurgy of Gold by T. K. Rose; Recovery of Precious and Secondary Metals from Electrolytic Copper Refining by M. A. Mosher, Transactions of the American Institute of Mining & Metallurgical Engineers, volume 106, February, 1934.

—Jewelry Metallurgist.

Electrochemical Society Meeting

Features Are What the Electric Furnace Has Done for Civilization, Theoretical Electrochemistry and Electrodeposition.

THE Seventieth General Meeting of the Electrochemical Society was held in Niagara Falls, Ontario, October 8-10. Headquarters were the General Brock Hotel.

On Thursday evening, Oct. 8th, Dr. Willis R. Whitney, Vice-President in Charge of Research at the General Electric Company Laboratories addressed the members on "More Research."

A number of trips were taken to points of interest about the Falls, and visits to industrial plants including the Union Carbide Laboratories, the North American Cyanamid, Ltd. and the Queenstown Plant of the Hydro Electric Power Commission of Ontario.

Abstracts of Papers:

THE CODEPOSITION OF METALS OF THE SAME VALENCE IN ACID SOLUTIONS

By W. George Parks and I. Milton LeBaron

The codeposition of metals, in which the two metals plating were of the same valence, was investigated. The following systems were included: Zn-Cd, Cu-Cd, Ni-Cu, Zn-Cu, and Ag-Tl. The cathode potential method previously described was employed at different current densities, at room temperature, in solutions of pH 5. The variation of codeposition with difference in electrode potential has been determined, and the equation derived for codeposition of mono- and bivalent metals of the same valence.

THE FORMATION AND GROWTH OF PITS IN ELECTRODEPOSITED METALS

By Michael Cymboliste

Pits in electroplating, notably nickel deposition, are attributed to bubbles, either of hydrogen or other gases. The origin of these gas bubbles is discussed at length and with the aid of numerous micro-photographs, different types of pits are illustrated. Furthermore, it is emphasized that most bubbles are non-adherent. The adherence of bubbles to the basis metal, or to the surface of the electrodeposited metal, is attributed to a wide variety of possible irregularities in this surface, such as scratches, nodules, foreign particles which have anchored themselves to the surface, etc. Gas bubbles may continue to adhere without increasing in volume, or they may grow in size and either remain at the surface or detach themselves and escape from the solution. The interposition of a thin coat of copper between two coats of nickel is suggested as a practical means for the elimination of pits.

POROSITY TESTS FOR ZINC-COATED IRON AND STEEL

By W. A. Koehler and R. O. Burford

It has been found practical to apply the Walker test for pin-holes, when iron or steel is coated with zinc, using an external e.m.f. to produce ferrous ions at the points where the iron is exposed. Paper impregnated with a test solution can also be used for the test with or without an external e.m.f., depending upon the nature of the metal coating on the iron.

THE ELECTRODEPOSITION OF MOLYBDENUM FROM AQUEOUS SOLUTIONS

By Wm. P. Price and O. W. Brown

A survey of the literature shows that G. F. Yntema claims that molybdenum can be deposited from an aqueous bath. The authors were unable to obtain bright deposits by following the method he outlined. In the experimental work of the authors, conditions were found for the plating of smooth, adherent, steel gray deposits of molybdenum, from an aqueous solution prepared by the electrolytic reduction of molybdic acid anhydride dissolved in sulfuric acid, using platinum electrodes. Baths were prepared both electrolytically and chemically and were used with and without addition agents. An attempt was made to obtain metallic deposits from each bath. Steel gray deposits of molybdenum were obtained under carefully controlled conditions.

WHAT THE ELECTRIC FURNACE HAS DONE FOR CIVILIZATION

By P. H. Brace

The early beginnings of the electric furnace are briefly described. The effects of metallurgical electric furnace technique upon ways of living in modern times are set forth with specific reference to the part played by the electric furnace in the production and uses of aluminum, magnesium, beryllium, chromium, tungsten, calcium carbide, phosphoric acid, silicon, manganese, and tantalum. Its use as a processing tool in the shaping of metals and in "copper brazing," etc., is mentioned.

RECENT ADVANCES IN THE ALUMINUM INDUSTRY

By Francis C. Frary

Advances in fabricating technique have enabled the industry to use alloys which have superior properties but were formerly found impractical because of fabricating difficulties. The aluminum-base alloys containing magnesium, first proposed many years ago but only recently commercialized, are examples of this. New equipment and knowledge also permit fabrication of larger wrought alloy articles (structural shapes, forgings, etc.), special extruded shapes and tubing. Alclad sheet, anodic oxidation, electrolytic brightening processes and fundamental studies of the design of aluminum alloy structures, are broadening the field of use of aluminum alloys.

(See page 439 for additional papers.)

The Comparative Evaluation of Modern Finishes

By LEO ROON
Roxalin Flexible Lacquer Co.,
Elizabeth, N. J.

The Problem of the Manufacturer is to Choose the Right One of a Wide Variety of Finishes Obtainable.*

IN OUR own field of surface coating materials, these years have witnessed the development of a whole new branch of finishing materials; namely, synthetics of the modified glycerol phthalate type, from the state where excessive enthusiasm proclaimed them to be the panacea for all finishing problems down to the point where they have found their proper niche between lacquers and oleoresinous finishes.

In these few years, more new raw materials have been developed for the making of film-forming products by the paint, varnish and lacquer manufacturer than in the entire one hundred years prior to this time. These raw materials include resins of the vinyl, alkyd and the phenolic types; new solvents of all classes, new plasticizers, new pigments, new driers and all of these run in number to the hundreds. New rubber compounds, new cellulose derivatives that, a short time ago, were expensive laboratory curiosities, are now commercially available, releasing new and interesting properties when correctly and skilfully formulated to meet the modern requirements of industry.

The new raw materials made available for our industry have opened up new fields of usefulness for organic finishes. A rather unique example of these new developments may be seen in the high degree of resistance to acids, alkalis, and other chemical reagents, which it is now possible to incorporate into finishing materials. We can now produce a single protective coating which has excellent resistance to such diversive corrosives as nitric acid, caustic soda solution, and alcohol; concentrated hydrochloric acid, sulphuric and chromic acids likewise do not affect it. We have a photograph which illustrates in a striking way the protection which such a clear coating can give over a white finish, of a standard non-resistant type. Perhaps the most remarkable aspect of this test is that the clear top finish has actually prevented the reagents from creeping under it, even though its margin, or outside edge, is exposed to them.

The real problem of the progressive manufacturer of surface coating materials is to carefully and completely evaluate these interesting new materials and to make them available to you in their proper form.

In the matter of evaluation, these seven years have given us some surprises with respect to some of our previously conceived notions, but they have also yielded new methods of testing, as well as a clearer interpretation of the results of these tests.

Due to the limited time allotted us, it will be the purpose of this paper to summarize rather than to delve too scientifically into evaluation methods of our own, or those developed by such able observers as Dr. A. E. Schuh[1] and his co-workers at the Bell Telephone Laboratories, or those developed and released from time to time by Dr. H. A. Gardner[2] of the Institute of Paint and Varnish Research, to which, incidentally, we refer those who desire more detailed and specific information.

Until three or four years ago, technicians felt that they had a very useful tool for the evaluation of finishes in the various types of accelerated weathering machines, which attempted to simulate artificial changes of temperature, humidity, sunshine, etc., but the Paint & Varnish Division of the American Chemical Society was suddenly shocked by Dr. Gardner[3] of the Institute when he stated that results obtained by accelerated weathering could not be properly correlated with the results obtained on similar panels, which had been given actual exposure in Florida and at other test points. So the accelerated weathering machine is today a tool of limited use to be relied upon only for comparative tests.

Another field in which it has become necessary to abandon accelerated chemical tests in favor of a plain ordinary service testing is in the case of perspiration resistance. For years, finishes were given a spot test with oleic acid, and if the finish did not break down in a matter of a few days the finish was considered to be perspiration resistant. Experience, however, of the last few years has taught us that nothing takes the place of perspiration in a perspiration test, and so now, as has been described by us in a previous article, discs are coated with the finishing materials in question, attached to a belt, and carried in contact with the skin around the stomach. The belt is removed regularly for examination against the standard disc until the finish breaks down. This belt illustrates both satisfactory and unsatisfactory finishes, in a perspiration test.

Then along came Dr. Schuh[1] who after several years of work came to a conclusion which he aptly summarizes in the following words: "The consumer of finishing materials is more interested in the health of a finish than in the manner of its death. In the customary methods of exposing finishes, the paint technologist is forced to act too much as the coroner and too little as the diagnostician. It has now been definitely learned that by the time visible signs of failure make their appearance, question as to whether the finish has finally failed by checking, cracking, or

*From The Monthly Review of the American Electro-Platers' Society, August, 1936.

[1] "Physical Evaluation of Finishes" by A. E. Schuh and H. C. Theuerer. Schuh, A. E., Ind. Eng. Chem., 23, 1346-52 (1931).
Schuh, A. E., and Kern, E. W., Ibid., Anal. Ed., 3, 72-6 (1932).
[2] "Physical and Chemical Examination of Paints, Varnishes, Lacquers and Colors" by H. A. Gardner.
[3] Technical Bulletins, 1936 series, National Paint, Varnish & Lacquer Manufacturers Association.

scaling becomes really a matter of quibbling. If the health and strength of a finish could be measured and followed in its youth and maturity, serious organic defects could be spotted and in the hands of the intelligent formulator immediately corrected." In other words, this new concept is analogous to the custom of the Chinese who pay their physicians to keep them well rather than for curing them when they become ill.

This suggested procedure is a great advance for our industry for it gives the technologist new and useful tools with which to observe weaknesses which may develop during the life of a finish and enable him to so formulate as to avoid finish failure under certain service conditions.

However, this kind of scientific testing must be carried out under carefully controlled conditions of uniform temperature and humidity; the panels must be very carefully prepared under conditions which yield films of uniform thickness, and the actual measuring of abrasion resistance (wear), impact resistance (adhesion) and flexibility must be carried out under properly controlled conditions regardless of the apparatus used. Comparative results of scientifically controlled tests, not only provide definite evidence of the superiority of one finish over another, but usually permit the expression of such results in tables or graphs for subsequent reference.

It is a sign of progress to note how many of the larger users of finishing materials are setting up their test laboratories, which enable their technicians to evaluate finishes under controlled conditions, and set up specifications from which to purchase their finishing materials to meet the standards which they have set up. But by and large, however, the average purchaser of finishing materials has to rely upon the ability and integrity of the lacquer, paint or varnish manufacturer to furnish him with finishing materials, which will sell his products and keep them sold, finishes which will completely satisfy the consumer with their appearance, life, and utility.

In a great many of such organizations, the finishing foreman is a man who has had years of experience in the application and in the observation of surface coating materials. It is a most surprising thing with what great accuracy he can evaluate the characteristics of the finish in the absence of scientific implements. He applies the finish to give the required appearance, and after the proper drying time he runs his sharp and horny, pet trained fingernail over the surface, mentally registering the measure of toughness of the finish.

Then out comes his trusty knife, and he whittles into the finish to see whether the film is alive and curly or whether it chips and flakes away from the surface; thus he registers the measure of adhesion. When he bends the panel back and forth a number of times and finds that the film distends to extent of the expansion of the metal, he registers his measure of the flexibility of the film. But experience has taught him that this characteristic of liveliness and distensibility of film changes with age and when he places the finish into his low temperature steam oven for long periods of time, and repeats his knife test and bend test without loss of adhesion or flexibility, he is in effect paralleling the scientifically controlled tests which are carried on in elaborately equipped laboratories. While his results do not permit of tabular or graphic expression, still, for his practical purposes, his results are equally as reliable as those more precisely arrived at. Regardless of the passage of time, the development of new thoughts, or the entrance of many new raw materials into the field, there remains unchanged, the old ideal of permanent flexibility and adhesion as the paramount criteria of a good finish.

It will interest you, I am sure, to tell you in closing that intimate talks with highly reputed paint, varnish and lacquer manufacturers in the important countries of Europe revealed the gratifying fact that the rest of the industrial world recognizes the leadership of the United States in the technique of lacquer and synthetic manufacturing, and in its applications.

Hot Tinning of Copper

Copper that is to be tinned by the hot dip process is usually fabricated into some form or other. The first step therefore, is to be sure all oil and grease have been removed. This is done by putting the work through a good commercial cleaning bath. The solution is kept at about 180 deg. to 200 deg. F. All of the article must be submersed in the solution so as to avoid oxidation. When the oil and grease have all been removed then the next step is to wash thoroughly in a hot water rinse at the same temperature.

When the work has been thoroughly rinsed, the next step is pickling. This is done in a mixture of nitric and sulphuric acids in the proportion of 1 gallon of 38 degree nitric acid, 1 gallon of 66-degree sulphuric acid, 1 gallon of water, and a little muriatic acid. When these acids are mixed, heat is generated and therefore, much care should be used. All acids etc. should be kept in stoneware. The pickling tank is a small acid-proof brick tank with a hood over it.

When the work has been given the bright dip in the pickling solution, it is again thoroughly rinsed, and then dipped in a liquid flux of zinc chloride. In order to have a high quality finish, attention is called to the fact that the solutions must be kept clean. The tin pot is filled with good commercial Straits tin and the temperature of the molten tin is held at 500 to 520 degrees F. depending upon the character of the work. The work when fully coated with tin is slowly withdrawn so that it will drain clean. When the piece has completely drained, it is then quickly quenched in a kerosene oil bath, cooled by a cold running water jacket.

The last step is drying the articles. This can be done in sawdust, and then if the articles are large, they can be wiped with soft rags. If small articles, they can be thoroughly dried in the sawdust, sifted and then blown with an airblast.—**Wallace Imhoff.**

Electroplating Research Progress

By DR. W. BLUM
Chairman, Joint Inspection Committee on Non-Ferrous Metals, A. E. S. & A. S. T. M.

Report on Exposure Tests of Electroplating on Non-Ferrous Metals*.

DURING the spring of 1936, several thousand specimens, chiefly of plated copper, brass, zinc, and die castings, with some steel and cast iron, were exposed in six locations. They have been inspected at least twice at each place. The attendance and the interest shown in these inspections have been very gratifying. The purpose of this report is not to state any conclusions, which might be premature, but rather to describe the steps that are being taken to reach sound conclusions regarding the value of plated coatings.

It will be recalled that for rating the coatings on steel, a scale from 5 to 0 was used, based upon the percentage of rust present. This scale proved satisfactory, and has been retained in the inspection of the new steel and cast iron specimens.

As it was difficult to predict what types of failure might occur on various other base metals, the numerical scale was not at first applied to them. Instead, each inspector recorded the appearance of the specimens, the types of failure observed, and the approximate extent (in per cent of the area) of such defects. Study of these observations showed that in industrial locations dark stains appeared on plated copper and brass. On zinc and die-castings, white stains appeared on some specimens. In addition cracks and blisters developed in some of the coatings. In milder locations most of the coatings are practically perfect.

In the compilation of results, and the quantitative comparison of different coatings, a numerical scale is very helpful. It was found that when the above descriptive observations were expressed on the numerical scale used for steel, but in this case including any major defects, the results were consistent with the thicknesses of the coatings. In the second inspections, numerical ratings were therefore assigned by each inspector. Longer periods will be required before valid conclusions can be drawn from these observations.

In the previous investigation of coatings on steel, it was recognized that the results of continuous exposure did not necessarily show the relative value of the coatings under service conditions that included cleaning and care of the plated parts. In order to obtain information on the effects of such treatments, a few of the badly tarnished specimens were cleaned by polishing with mild abrasives, which practically restored the original luster of the chromium finish. In addition, a few of the cleaned coatings were treated with grease or wax (such as is commonly applied to exposed plated parts) in order to learn whether such treatments add to the protective value of the coatings under severe conditions. If a decided improvement is noted, a systematic study of such effects will be included in the investigation.

Color photography has been suggested as a means of recording the appearance of the specimens at successive intervals, and thus assisting in the comparison of various specimens in different locations. Through the generous cooperation of several persons and firms, a number of color photographs of the specimens have been made with different types of film and of exposure. The results thus far obtained are promising, though further study will be required to define the conditions for permitting quantitative comparisons of the tarnish and corrosion.

Laboratory studies upon methods of measuring the thickness, distribution, porosity and protective value of these coatings are in progress.

From the above notes it may be seen that the greatest value can be obtained from any such investigation only if continuous efforts are made to apply to it, or to at least try out, new ideas and new methods. The committee is greatly indebted to those persons who have made suggestions, and who have cooperated in the inspections and related activities, and will welcome further comments and criticisms.

* From the Monthly Review of the American Electro-Platers' Society, October, 1936.

Electrochemical Society Papers

THE AJAX-HULTGREN SALT BATH FURNACE

By Wm. Adam, Jr.

The nature of the metal surface secured in an activated fused salt bath is determined by the type of steel used, the composition of the bath, the time immersed in the bath, and the temperature. The activated or accelerated fused cyanide baths are a more recent development. The case hardening penetrates deeper into the surface of the steel than with the fused cyanide bath. The accelerator is usually $CaCl_2$ or $BaCl_2$. There is a double reaction, each of which releases carbon, and this explains why a deeper case can be obtained with the activated salt bath. The old fuel-fired cyanide pot has been superseded by the electrically heated salt bath, notably of the Ajax-Hultgren design. Alternating current at 8 to 30 volts, and 1,000 to 5,000 amperes is fed into the salt bath with a pair of electrodes. The operation and advantages of the Ajax-Hultgren salt bath furnace are discussed in detail. In general, the "fuel" cost of the electric furnace will average about one-half the fuel cost of a gas-fired pot.

Recovering Copper and Zinc From Brass

Q.—I have to reclaim from brass scrap (67 Cu, 33 Zn) in the shape of cartridges and bullets; first the copper of electrolytic purity and the zinc as such. The logical procedure in my knowledge would be to dissolve all the metal in percolating towers in a current of hot air against a spray of sulphuric acid 30% to obtain a mixture of zinc and copper sulphates acid, which would have to be electrolyzed using insoluble lead anodes. The electrolyte in question would partly be stripped from its copper and at the same time its acid radical would be regenerated enriching the solution with the equivalent of sulphuric acid and remaining the originally dissolved zinc as sulphate. This solution could be used over again to dissolve more brass and so on until the zinc concentration as sulphate would be too high (8%) for further electrolysis. When this point is reached the low percentage of copper still in solution is precipitated as sulphide by hydrogen sulphide and or neutralized by zinc dust which also precipitates the copper in solution as well as other metals contaminating the solution less electropositive than zinc. This solution would be evaporated and crystallize the zinc sulphate for the market or to use it as electrolyte for the production of electrolytic zinc.

The purpose of reclaiming the copper and zinc contents of the scrap is to start with pure electrolytic metals in the production of brass 67-33 for the manufacture of cartridges in the ammunition factory as their required characteristics for such brass are very exacting and rigorous. For this reason the brass in question is not melted, cast and rolled to make cartridges anew.

If you have a better process for the separation of copper and zinc from brasses I shall be very much indebted to you.

A.—The process outlined is a good paper method —nothing wrong with it theoretically—but too expensive to be commercial.

1. Solution of brass in aerated hot sulphuric is not as easy as it sounds on a large scale operation, and much money would have to be spent before a satisfactory apparatus could be designed.

2. Electrolysis with insoluble anodes is expensive —high voltage—minimum 1.80 and much higher as the zinc contents increased. Electrolysis could only be carried out to a certain copper content; beyond that poor efficiencies and poor copper deposit.

3. Zinc electrolysis is not simple and requires experience; too much for this process.

If it must be done, I would prefer blowing out the zinc, catching the zinc oxide in bag houses, making anodes of the copper and electrolyzing. Even with this there would be plenty of grief and losses. Reclaiming of scrap is no business for anyone who is not ready to spend a great deal of money, and it must be large scale operation.—**Metallurgist A.**

A.—The reclamation of copper from brass scrap is hardly practical, partly because of the losses involved, partly because of the material would not fit into the regular intake of the copper refiners, causing pollution, etc., and partly because such huge quantities would have to be involved.

It seems to me if specifications are "very exacting and rigorous," as they are of course, they should not play with anything but primary metals of known quality. I use the term "primary" in the sense of properly refined, irrespective of whether the copper or the zinc is virgin or secondary. At least that applies to copper. Zinc is so cheap that they better start off with good metal for there is plenty of it around.

They could then sell the scrap to the refinery and take back good copper and procure their zinc elsewhere.—**Metallurgist B.**

Soft Nickel Solution

Q.—We are installing a larger nickel tank in our plant. We would appreciate it if you could give us a few suggestions.

We want a soft nickel solution with a good throwing power. We anticipate making up the solution with distilled water to be used at room temperature, and intend to use 95% to 97% anodes bagged. The tank will be 12 feet long, 4 feet wide, and 36 inches deep.

We use brass reflectors. The deepest one we have is 14 inches in diameter and 4½ inches in depth and our largest ones, shallower than this one up to 18 inches and 24 inches.

A.—The use of the following solution will produce a soft nickel deposit with good throwing power:

Single nickel salts	12 ozs.
Double nickel salts	4 ozs.
Ammonium chloride	3 ozs.
Boric acid	3 ozs.
Water	1 gal.
pH	5.8-6.0

Temp. 78-85 deg. F.; current density 5-15 amps./sq. ft.; voltage 1½ to 3 volts; anodes 99% rolled depolarized. The anodes should be bagged. The metal content is replenished by adding single nickel salts.

Pitting of nickel deposit can be overcome by adding hydrogen peroxide in the amount of 1 pint per 100 gallons of solution.—**T. H. Chamberlain.**

Hot Tinning of Brass

The hot dip tinning of brass or bronze castings requires a little different handling. It may not be necessary to pickle some classes of articles. If clean, they can be put in the flux of zinc chloride and put through the tin bath in the usual manner. However, if the castings have any sand on them, they can be first sand-blasted, or if not necessary they can be placed directly in a bath of hydrofluoric acid. This will dissolve all traces of sand. They are then thoroughly washed, fluxed and put through the bath as usual. They are withdrawn, shaken and if parts are threaded they must be wiped. The glossy finish is given by the oil quench. A good high quality Straits tin is also very important in obtaining a high quality finish.—**Wallace Imhoff.**

Editorial Comment

Odds and Ends of Copper

THE oldest metal, many say the most beautiful metal, and perhaps still one of the most widely used in point of diversified products if not in tonnage, is our old stand-by, staff and support, Copper. Certainly, no metal has a more interesting history.

To Copper and Brass Research Association we are indebted for reminding us that 8,000 years ago Egyptians knew how to hammer native copper into knives, weapons and other implements; that the Hildesheim Cathedral in Germany has a copper roof which was laid on in the year 1320; that bronze razors over 3,000 years old have recently been unearthed in Austria. (Man evidently shaved himself thousands of years ago. He probably complained less about the dullness of his razor than we do to-day!) In 1659 Sweden issued a copper coin worth $5.20, which weighed 31 pounds and measured roughly two feet by one foot.

The name copper is derived from the Latin word Cuprum, which was shortened from "Aes Cyprium," meaning a metal of Cyprus on which island it was originally found. The largest brass cannon ever cast weighs 80 tons. It was made in India in 1548. We can imagine how it was cast but no one knows how it was transported. Paul Revere, who will live in American history for his famous midnight ride, will live in industrial history as the first American manufacturer of copper sheets and bolts. The luxurious Baths of Diocletian in ancient Rome, which accommodated over 3,000 bathers at one time, were equipped with bronze pipes. In the wilderness of India is a group of huge copper kettles used by pilgrims who visit the Hindu Holy Men living there in caves. One of these kettles is large enough to boil a dozen bulls at once. How those kettles got there is a mystery as there is no copper within thousands of miles of them. A brass clock made for Philip the Good of Burgundy in 1439 still keeps good time. A copper pipe removed from the 5,500-year-old pyramid of the Egyptian Pharoah Cheops still holds water.

And as for copper to-day—the bronze Statue of Liberty is now 50 years old; the new superliner, Queen Mary, carries four propellers of manganese bronze, each weighing 35 tons. The Grand Central Terminal in New York is protected by a sheet copper roof 25 years old; Quaglino's Resturant in London has a new sheet copper ballroom floor, the first of its kind. The copper roofs on the buildings in Germany which were ripped off to make shells have since been restored. The lower classes in Turkey invest their savings in copper utensils and by the number and quality of these utensils is measured their standing in the community. In the United States there are 1,864,643 miles of copper telegraph lines. Copper sulphate is an important addition agent to fertilizers and increases crop yields in corn, wheat, potatoes, tobacco, cotton, etc. More than 30,000,000 pounds of copper were used in the construction in connection with the Boulder Dam.

And our average yearly rust bill is estimated at one billion dollars.

We have no doubt that our readers will be able to see the moral!

Metals and Building

WITH building again beginning to show its head above water, it will be interesting to note the significant trends within this field which affect metals.

During the past year there has been a marked trend toward the use of more copper for tubing, for supply and heating lines, for extruded architectural shapes and for building sidings. Monel metal is gaining popularity for roofing and for tie wire for hanging ceilings. Residential houses are using more aluminum windows of the double-hung and casement types and also extruded shapes of aluminum. The use of lead has increased for roofing, flashing, spandrels, mullions and finials. Hospital rooms are now being shielded from x-rays by lead sheets in the walls. Lead anti-vibration mats are put under columns at the foundations to minimize noise and vibration.

The improvement in the class of buildings, the trend away from "jerry" built houses, means definitely that as this industry increases, metal products consumption will rise at an even greater rate.

The Future of Electrodeposition

A SUMMARY and a glance into the future are always interesting even though they may tell us nothing of revolutionary import. For that reason a paper by Dr. H. J. T. Ellingham read at a recent meeting of the British Association for the Advancement of Science, attracts our attention. Briefly, Dr. Ellingham points to the following lines of development.

More precise control of the plating process which will lead to improved quality of the coatings.

An increase in the number of metals deposited. No metal is so rare that the possibility of its commercial electrodeposition can be definitely ruled out as so very little metal is required to produce a coating.

The deposition of alloys—two or more metals of almost any range of composition.

A wider range of application of deposits; in other words, on new articles of manufacture.

Dr. Ellingham points out that there is and will continue to be competition from other types of coating and surface treatment. Nevertheless, the few items listed above give the plating industry plenty of room for expansion for decades to come.

Business Activity

EVEN though this is a presidential election year, business has been steadily forging ahead. The National Industrial Conference Board reports the general outlook for the Fall to be favorable although industrial activity during August showed little change from the preceding month. Employment and earnings gained in September. The expansion in the steel industry and in residential building has served to offset declines in other fields. The General Electric Co., which may be large enough to be taken as an indicator, reported orders received during the third quarter of 1936 to be 38 per cent above the same period of 1935.

The immediate prospects are decidedly favorable.

Shop Problems

This Department Will Answer Questions Relating to Shop Practice

METALLURGICAL, FOUNDRY, ROLLING MILL, MECHANICAL, ELECTRO-PLATING, POLISHING, AND METAL FINISHING

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Etching Shear Blades

Q.—In looking for a client the problem has come up for an efficient and mark and so forth, for cast, shear and scissor blades.

If you have any information on the detail of this subject or can give me any references which might be of value in this connection, I would appreciate it greatly.

A.—The following method can be used for etching trade-mark on cast, shear and scissor blades.

1. Clean by wiping with carbon tetrachloride, then by wiping with lime. Possibly carbon tetrachloride can be omitted.
2. Varnish with No. 2 varnish.
3. A rubber stamp should be made with design or name to be used. Stamp with caustic from moist cotton pad. Two teaspoons of powdered caustic soda, dissolved in 5 tablespoons of water gives proportion.
4. Protect parts not to be etched, with thin No. 1 varnish. Dry. Cover area to be etched with No. 1 varnish, thinned with ¾ benzol and ¼ turpentine. Dry. Drying takes at least 20 minutes and longer time gives better results. Apply varnish by good quality camel's hair brush. Varnish must be applied evenly and not too thick so that it may be washed off. Too thin varnish will be indicated by acid staining through varnished parts.
5. Wash off varnish and caustic from part to be etched with soft camel's hair brush and water. Rub very lightly till area is clear.
6. Etch clear area with acid, applying with soft dauber. Acid used is 1-part C.P. hydrochloric acid and 2 parts water, by volume to which potassium dichromate has been added in excess of saturated solution.
7. Pat with moist chamois to remove surplus acid.
8. Remove No. 1 varnish with kerosene.

Remove No. 2 varnish with alcohol, denatured.

Wipe polished surface with oil to prevent staining.

—T. H. C., Problem 5,537.

Musical Instruments and Baby Shoes

Q.—I am in the plating work in just a small way, plating musical instruments (saxs, trumpets, saxophone keys etc.) and I would like to know if I could use a black iron tub lined with tar as a container for my plating solution.

I would like to have you tell me if possible the procedure necessary in the plating of baby shoes.

A.—The solution you intend to put in the tank is not mentioned. It is assumed you are using a cyanide silver solution. For this, a plain steel tank is best. Asphalt lined containers are used but such lining is unnecessary in a steel tank.

To plate baby shoes, make up a weak solution of shellac in denatured or wood alcohol. Dip shoes in this solution. Allow to dry. Repeat until leather is impregnated. Then spray with a bronze lacquer, that is, a clear lacquer to which has been added some thinner and some bronze powder. The Platers' Guidebook 1931 edition recommends the following:

Platers' copper bronze powder	3 ozs.
Cellulose lacquer free from gum	¼ pint
Lacquer thinner	¾ pint

Allow the bronze to dry. Apply another coat. Dry. Then hang in a copper sulphate solution with connections made at several points with copper wires. Use a copper sulphate solution made up of:

Copper sulphate	27 ozs./gal.
Sulphuric acid	6.5 ozs./gal.

—G. B. H., Jr., Problem 5,538.

Nickel and Silver-Nickel

Q.—I am sending a sample of nickel and silver nickel solutions to be analyzed and would appreciate it if you will publish the results and recommendations for these solutions. I believe the nickel solution to be alkaline but if I lower the pH pitting occurs. The silver nickel solution was made of:

H_2O	5 gallons
NaCl	3¾ pounds
AgCl	4½ ozs.
$Ni(CN)_2$	3 ozs.

A.—The analysis of the nickel solution is:

Nickel	2.94 ozs./gal.
Chloride, as ammon. chloride	2.89 ozs./gal.
pH	6.8

The nickel and chloride are all right but the pH is much too high. This can be corrected by adding sulphuric acid. Approximately 16 fluid ounces of sulphuric acid should be added per 100 gallons. The additions should be made over a period of a few days and the pH checked during the additions to determine when correct value of 5.8 to 6.0 is reached.

If trouble is being experienced with pitting relief can be had by adding

USE THIS BLANK FOR SOLUTION ANALYSIS INFORMATION

Fill in all items if possible.

Date.....

Name ..... **Class of work being plated:** .....

Address ..... **Volume used:** .....

Employed by: ..... **Solution depth:** .....

Kind of solution: ..... **Cathode surface, sq. ft.:** .....

Tank length: ..... **width:** ..... **Kind of anodes:** .....

Anode surface, sq. ft.: ..... **Distance from cathode** ..... **Original formula of solution:** .....

REMARKS: Describe trouble completely. Give cleaning methods employed. Send small sample of work showing defect if possible. Use separate sheet if necessary.

NOTE: Before taking sample of solution, bring it to proper operating level with water; stir thoroughly; take sample in 2 or 3 oz. clean bottle; label bottle with name of solution and name of sender. PACK IT PROPERLY and mail to METAL INDUSTRY, 116 John Street, New York City.

hydrogen peroxide or an anti-pitting agent.

The analysis of the nickel-silver solution is:

Silver	1.02 tr. ozs./gal.
Nickel	none
Free sodium cyanide	3.80 ozs./gal.

This analysis shows that in the operation of a solution such as mentioned in the original formula that it is difficult to maintain the nickel content. This is due to the fact that nickel will not go into solution from the anodes in a cyanide solution.

In addition, the deposit will be primarily nickel, until the nickel in the solution is depleted.

—G. B. H., Jr., Problem 5,539.

Nickel and Silver Troubles

Q.—I am enclosing one plate from a Swiss watch. I desire to duplicate this finish. Please advise me the process and formulas used.

I desire to know more about gold plating the engraving on blue steel guns. We need a stop out varnish which will not peel or blur with the action of the engraver and also protect the delicate blue finish. (Outline process.)

Would like to know a formula for a real white silver dip for watch dials silvered by silver powder process.

A.—The deposit on sample part submitted is nickel which has been colored buffed to a high lustre. The part has been first buffed and colored and then nickel plated and colored. The following solution can be used for depositing nickel:

Single nickel salts	12 ounces
Double nickel salts	4 ounces
Ammonium chloride	3 ounces
Boric acid	3 ounces
Water	1 gal.
pH	5.8 to 6.0

Temp. 75-85 deg. F; current density, 5-15 amps./sq. ft.; voltage, 1½-3 volts; anodes, 99% rolled depolarized nickel.

The anodes should be bagged. If the pH is too high add sulphuric acid; if too low add ammonia. The metal content is replenished by adding single nickel salts. Pitting of the nickel deposit can be overcome by adding hydrogen peroxide in the amount of 1 pint per 100 gallons of solution.

A Number 0 or Number 00 varnish, air dried will not peel or blur with the action of an engraver's tool.

A silver dip solution of the following composition will produce a white deposit if base metal has a good mat finish:

Silver cyanide	4.0 ozs.
Sodium cyanide	6.0 ozs.
Water	1 gallon
Temperature	120 deg. F.

—T. H. C., Problem 5,540.

Plating Basket or Rack for Gold

Q.—We are at the present time gold-plating very considerable quantities of small brass articles which we are forced to string on brass wires (about 300 to the string) for proper contact and quick flash (10 seconds).

We should like very much to do away with the expensive stringing and attempt plating in bulk but fear injury to our bath if we use a metal basket which will perhaps not only break down and go into our solution but will take a gold plate itself.

Do you know of a metal we could make such a basket from that while carrying the necessary current and giving proper contact would not have the injurious and expensive tendencies mentioned above? Would a basket of aluminum say remain untouched by a gold solution, or would a brass basket heavily plated with the newer finishes such as chromium or cadmium do the trick for us?

We shall appreciate anything you can do to aid us in our problem. We have considered it unnecessary to describe our gold solution as we find ingredients for all are more or less standard.

A.—To be able to produce a uniform deposit and color in a gold flash of 10 seconds it is necessary to have good contact. The use of metallic baskets for flashing small parts is not satisfactory, due to the fact that it is not possible to obtain sufficient contact.

Brass baskets, chromium or cadmium plated will take on a deposit of gold. A chromium plated basket will take a deposit of gold which will not adhere but will eventually flake off. The use of aluminum baskets is not feasible, due to the fact that aluminum is readily soluble in alkaline solutions.

If the parts are of such shape that they can be racked easily, it is suggested that a coated rack be used with only enough metal surface exposed to effect good contact. The racks can be coated with a non-conductor or its equivalent which will prevent gold depositing only on small surface exposed for contact. This rack might be circular, of sufficient size, made up of a number of wire circles with hooks of sufficient size and centers for the work you have.

The entire rack could be coated and the coating on a small portion of the hook, just enough for contact, is removed by filing. The rack can be used indefinitely with new coatings as they wear off. The size of rack is dependent upon volume and size of tank used. This type of rack is being used successfully for small buckles, etc.

—T. H. C., Problem 5,541.

Plating on Porous Castings

Q.—Enclosed are three samples of brass plate done in the following solution:

Copper cyanide	4 ozs.
Zinc cyanide	1 oz.
Sodium cyanide	6 ozs.
Sodium carbonate	2 ozs.
Water	1 gal.

I am having trouble as shown by small discolorations appearing both on the front and back. Some are no larger than a pin head but later they turn dark and spread and on plain work they are very noticeable.

Kindly tell me how to avoid this and also please send an **easily relieved** oxidize for the solution above.

A.—The spots appearing on samples submitted are due to the porosity of the castings. To overcome this condition it is necessary to rinse the castings well in both clean cold water and hot water; then heat for at least 1 hour at 250 deg. F. This treatment is to be done before castings are given final finishing operations. If the brass deposit is to be oxidized, the oxidizing should be accomplished before heating. The following solution can be used for oxidizing:

Liquid sulphur	1 ounce
Water	1 gallon

The work is immersed in this solution for a minute or so, and then without rinsing immersed into a solution made of sulphuric acid 1 ounce, nitric acid 1 ounce, water 1 gallon. If color is not dark enough repeat both dipping operations and scratch brush dry.

To preserve finish the article should be given a coating of lacquer that is impervious to moisture. Any reliable lacquer manufacturer can supply such a lacquer.

—T. H. C., Problem 5,542.

Red-Brown on Brass

Q.—I would appreciate very much if you'd furnish me with the information as to how to get a reddish-brown color on brass castings. The sample that was shown to me was of brass metal and oxidized (reddish brown color) and relieved with a sponge dipped in cyanide. I used liver of sulphur. I also tried antimony sulphide, caustic soda, but they all come out more of a dark brown than a red-brown, I can not plate them, because of relieving which must be brass. I know that if I could plate them in copper or bronze there would be no trouble at all.

A.—An oxidizing solution that can be used to produce a color as described, consists of:—

Barium sulphide	¼ oz.
Oxidizing liquid	1/16th oz.
Water	1 gal.

First dip the brass in a strong caustic solution.

Rinse.

Immerse in above oxidize for a few seconds.

Rinse.

Dip in a sour water composed of 1% solution of sulphuric acid.

Rinse.

The rinse after oxidize should be a different rinse from the one used after the acid, as the two solutions cannot be mixed and obtain uniform or proper color.

Repeat the above operations as mentioned until desired shade is obtained.

—G. B. H., Jr., Problem 5,543.

Practical Brass Foundry Digest

By H. M. ST. JOHN

Chief Metallurgist, Detroit Lubricator Company; Associate Editor, METAL INDUSTRY.

Short Abstracts of Articles of Interest to Practical Non-Ferrous Foundrymen and Metallurgists.

The Evaporation of Metals. L. R. Jackson. Metals and Alloys, Vol. 7, page 160, June, 1936.

The vapor pressures of a large number of metals, at temperatures from—20°C to 5000°C, are shown graphically. Although the brass industry finds the high vapor pressure of zinc troublesome it probably serves a useful purpose in preventing the solution of other gases which would result in unsound castings.

Progress in the Clarification of Problems in High and Low Temperature Uses of Metals. H. W. Gillett, Metals and Alloys, Vol. 7, page 166, June, 1936.

A note describing the work of the Joint Committee sponsored by the A.S.M.E. and the A.S.T.M.

Founding Aluminum Bronze Castings. M. T. Ganzauge. Foundry, Vol. 64, June, 1936, page 24.

A description of foundry practice illustrated by photographs showing methods of using chills, horn gates, etc. A novelty in the case of large castings is the use of carbon dioxide gas with which the mould cavities are filled, displacing the air which otherwise tends to form seams and folds.

Casts Bronze Parts for Pumps. Pat Dwyer, Foundry, Vol. 64, June, 1936, page 32.

Description of plant layout and practice at the Northern Pump Co., Minneapolis. More than 25 different alloys are used. Detroit electric furnaces are employed for the bronze mixtures, crucible pit fires for aluminum.

Coloring of Metals. (3) White Metals.—Herbert R. Simonds and C. B. Young. Iron Age, Vol. 137, June 18th, 1936, page 30.

Variations in composition are not effective in coloring the white metals. Aluminum may be colored by chemical methods or by anodizing. In the latter process the metal is covered, by electrochemical treatment, with a tightly adherent coating of aluminum oxide which may then be given any desired color by means of organic dyes. Formulae are given. Methods for coloring other white metals and electroplated coatings are also described.

Coefficient of Equivalence of Iron with Respect to Aluminum in Aluminum Bronze. J. L. Bray, M. E. Carruthers and R. H. Heyer. Metals Technology, Vol. 3, June, 1936.

An iron content of 2 to 4 per cent results in the formation of a new constituent which markedly affects the properties of the alloy. The authors conducted a series of experiments which led them to the conclusion that, unless the iron is added as an iron-aluminum intermetallic compound, it does not influence the solid solution relationship of the copper and aluminum. The presence of iron accelerates the eutectoid transformation on cooling but does not shift the transformation temperature.

Equilibrium Relations in Aluminum-Zinc Alloys of High Purity, II. William L. Fink and L. A. Willey. Metals Technology, Vol. 3, June, 1936.

An experimental determination of the solid solubility of zinc in aluminum at elevated temperatures.

Age-hardening of Aluminum Alloys. I.—Aluminum-copper Alloy. William L. Fink and Dana W. Smith. Metals Technology, June, 1936.

According to the original theory the age-hardening of duralumin is due to the precipitation of Cu Al_2 in small particles. Experimental work by the authors indicates that this simple theory still holds good in spite of various objections which have been advanced against it.

Equilibrium Relations in Aluminum-Magnesium Silicide Alloys Containing Excess Magnesium. F. Keller and C. M. Craighead. Metals Tech., June, 1936.

As a rule magnesium and silicon are added in such a proportion as to produce Mg_2Si, the age-hardening constituent, commonly with some excess of silicon since any excess of magnesium reduces the solubility of Mg_2Si in aluminum. Experimental results are described with tables and graphs.

A Quatenary Aluminum-Silicon Alloy. G. Welter. Metal Ind. (London), Vol. 48, page 627 (June 5th, 1936).

The article describes a casting alloy known as Cetal, an aluminum-silicon alloy said to have better casting properties than the aluminum-zinc and aluminum-copper alloys, together with better mechanical properties than the conventional aluminum-silicon alloys, such as Silumin or Alpax. These points are extensively illustrated by tables and curves. The composition of Cetal varies according to the quality and properties desired; the essential elements are copper (3%), zinc (10%), and silicon (6.5%) and sometimes magnesium (0.3%), the figures given being for a typical composition. If silicon is introduced as 97% ferrosilicon the undesirable excess of iron can be compensated by the addition of 0.3% manganese. In general the alloy is not sensitive to impurities and scrap materials may be used freely.

Review of the Fields in Which Zinc Die Castings are Used—Part II. Herbert Chase. Metal Ind. (London), Vol. 48, page 635 (June 5th, 1936).

A continuation of earlier articles. (See previous abstracts).

A Copper-Silicon-Manganese Alloy: Properties and Applications of Everdur. Anon. Metal Ind. (London), Vol. 48, page 638 (June 5th, 1936).

A description of this well known American alloy, giving physical properties, uses and foundry technique, with pictures of typical gating. Everdur castings may be toughened by annealing at 700 to 730° C (1292-1346°F) followed by quenching. This also improves machinability. Pattern allowance is the same as for brass or bronze.

Recommendations for Two Leaded Gunmetals. By the Non-ferrous Subcommittee of the Institute of British Foundrymen. Metal Industry (London), Vol. 48, page 660 (June 12th, 1936).

The British Standards Institution specification (B.S.S. No. 383/1930) for Admirality gunmetal is given. There are no standard specifications for leaded gunmetals which are also widely used within the range: 82 to 93% copper, 4 to 9% tin, 0 to 7% lead, 1 to 8% zinc. The Committee suggests two standards within this range, G.M. 2, 87 copper, 9 tin, 3 lead, 1 zinc and G.M. 3, 85 copper, 5 tin, 5 lead, 5 zinc. A large number of tests made by seven co-operating foundries with these alloys are summarized. The Committee considers it futile to design test bars intended to be representative of the metal in commercial castings; it suggests two test-bar patterns designed to promote duplication of results. The use of Brinell hardness and density are suggested as optional tests, and the results obtained by the seven foundries under a variety of casting conditions are given.

Castings for Hydraulic Equipment. Anon. Metal Industry, Vol. 48, page 663 (June 12th, 1936).

The plant of Glenfield & Kennedy, Ltd., at Kilmarnock, is described.

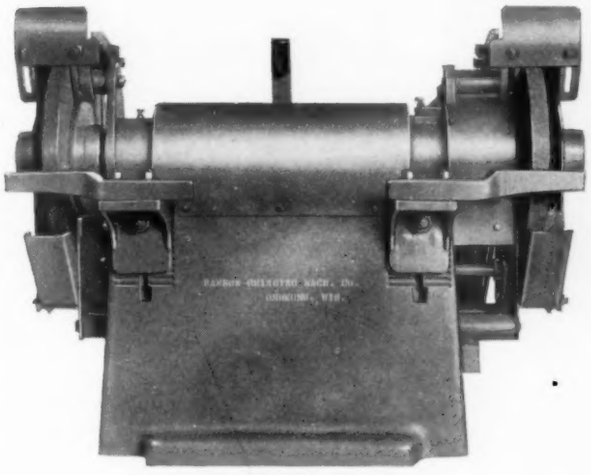
Modern Equipment

New and Useful Devices, Metals, Machinery and Supplies.

New Grinding Machine

The Ransom Type C grinding machine is built for operation of 24" and 30" high speed wheels for foundry grinding. There are 4 changes of speed accomplished by means of changing the sheaves on the motor. The drive from the motor to the spindle is by tex-ropes which run from sheaves of unusual larger size sheave should be put on to speed up the wheels. A 15 H.P. motor is bolted rigidly to the back of the machine. Machine is equipped for operating wheels with 12" hole, both for the 24" and 30" size. The weight of the 24" machine is 3,850 lbs. and the 30" machine is 3,900 lbs.

Two advantages are specially emphasized. One is that with little time, changes in the speed can be made as the wheels wear down in diameter, less than five minutes being required to make the change. The other feature is that the tex-ropes can be put on without disturbing the arbor. Previous to this, it has been necessary to go to considerable trouble, either removing couplings from the main spindle or removing housings in order to put new tex-ropes on.



Ransom Type C Grinding Machine

diameter on the spindle. This sheave is placed outside the right hand end bearing and is so arranged that new tex-ropes can be installed without disturbing the arbor. It is necessary only to remove one of the emery wheels and slip the tex-ropes over the arbor.

The speed is controlled so it is impossible to overspeed the wheels and is so arranged that it is apparent from the front of the machine when the next

Testing Buffing Compounds

The testing of buffing and polishing compositions has very often been a haphazard, hit or miss proposition. The human element has entered into it so often that a fair, unbiased test has been difficult to get even with the best intentions. To overcome this condition E. Reed Burns Manufacturing Corporation, 21-29 Jackson Street, Brooklyn, New York, have worked out and issued a "Test-Check" card.

This card lists the five variables which enter into the cost of a buffing operation.

1—Weight of composition used.
2—Weight of buff used.
3—Time elapsed.
4—Hourly rate.
5—Unit finished.

These cards are printed in convenient form on heavy stock with two columns, one for the material being tested and the other for comparison with present stock. They will be furnished free of charge upon application to the above company.

The use of these cards will make possible a simple, permanent and accurate record of every sample tested.

Latest Products

Each month the new products or services announced by companies in the metal and finishing equipment, supply and allied lines will be given brief mention here. More extended notices may appear later on any or all of these. In the meantime, complete data can be obtained from the companies mentioned.

Wet Abrasive Cutting Machines. No. 0 Tool Crib Cutter; a small unit for cutting many materials quickly. Andrew C. Campbell Div. of American Chain Co. Inc., Bridgeport, Conn.

Small Centrifugal Pumps; low-cost. Worthington Pump and Machinery Co., Harrison, N. J.

Freeze-Proof Water Coolers for Factories. Westinghouse Electric & Mfg. Co., Mansfield, Ohio.

"Shield Arc SAE.". New continuous dual arc control welder Lincoln Electric Co., Cleveland, Ohio.

Type S Diesel Engine. Vertical, four-cycle, single-acting, solid injection type for medium speeds and heavy duty continuous service. Ingersoll-Rand Co., 11 Broadway, New York.

Lindberg Throttling Control; temperature control unit; provides extreme sensitive control and precision in heating. Lindberg Engineering Co., Chicago, Ill.

Oxweld Shape Cutting Machine. Type CM-12; accuracy, precision and a wider range of flame cutting work. Linde Air Products Co., 205 E. 42nd St., N. Y.

Automatic Orsat Apparatus; for analyses of flue gas sample in 20 seconds The Hays Corp., Box 299, Michigan City, Ind.

New Automatic Welding Head; uses standard coated rods; "Robot" type operated by remote control. Harnischfeger Corp., Milwaukee, Wisc.

Pipe Clamp for Stopping Leaks in Pipes; can be applied while the lines are in service except with extremely high pressures. M. B. Skinner Co., 3691 W. Sample St., South Bend, Ind.

Aftercooler and Porous Stone Filter. Type AF for removing water from compressed air by cooling and filtering; also removes 100% of the oil contamination. R. P. Adams Co., 220 Delaware Ave., Buffalo, N. Y.

Stapling Tool; pocket size stapler for binding corrugated boxes. Acme Steel Co., 2832 Archer Ave., Chicago, Ill.

Dust Counter; sampling dust countering apparatus for checking dust concentration in the plant. Bausch & Lomb Optical Co., Rochester, N. Y.

Doall Etching Pencil. A new "electric pencil." Continental Machine Specialties, Inc., Minneapolis, Minn.

More Flexible Furnace

Modern production methods demand the unusual in flexibility. As an example, the furnace shown operates at temperatures of 575° F. to 2,950° F. under Program Control, allowing for controlled temperature increases or decreases at definite rates of time.

Five groups of PDM tunnel burners are used to uniformly distribute the temperature. The air-gas ratio is controlled by the improved PDM proportional mixing system.

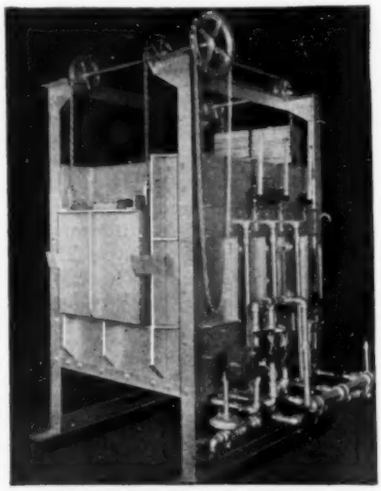
The lining consists of Sillimanite brick and K-30 insulating brick, both of these materials being especially adapted for the wide temperature range desired.

This furnace has met all requirements as to temperature, uniformity, control, flexibility and economy in operation.

These furnaces are manufactured in 20 standard sizes and are designed for operation with oil; artificial, natural, propane or butane.

Muffles of refractory or alloy can be supplied for special heat treating operations. Five types of automatic temperature control equipment can be supplied to meet any industrial requirements.

This furnace is made by the Philadelphia Drying Machinery Company, 3350 Stockley St., Philadelphia, Pa.



PDM Flexible Operation Furnace

Automatic Polishing and Buffing Machine

An oscillating machine used in conjunction with the standard lathe for polishing and buffing "out-of-round" work, such as oval or rectangular roasting pans, square waffle bases, cake pans, tureens, etc., has been designed by the Acme Manufacturing Co., 1645 Howard St., Detroit, Mich. The illustration shows the machine equipped with a special stroke adjustment allowing the work to stroke across the face of the wheel as well as oscillate.

One operator, it is stated, usually runs two machines, one set at each end of the lathe. While one machine is revolving the work in contact with the polishing or buffing wheel, the operator is unloading and loading the other machine.

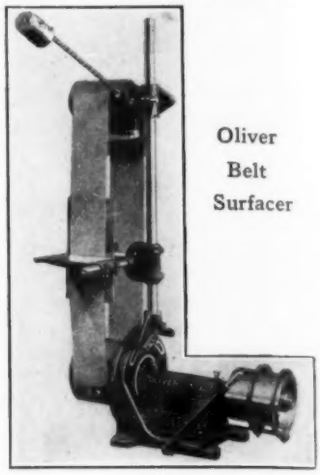
Net weight approximately 750 pounds; floor space 24" x 44".

Acme Automatic Polisher

Belt Grinder and Polisher

The "Oliver" belt grinder and polisher has been developed by the Oliver Machinery Co., Grand Rapids, Mich., a flexible and adaptable belt surfacer and polisher for metal working operations. It is designed for the rapid grinding and polishing of all kinds of small and medium sized metal pieces in a wide variety of shapes. It is recommended for use in large and small plants, toy factories, pattern shops, ornamental metal manufacturing plants, etc.

The machine consists essentially of a main drive pulley mounted on a countershaft located on a substantial base with a frame swinging about the center line of countershaft and carrying a support arm. On this support arm are carried two clamp brackets, one of which supports the main idler pulley and the tension idler. The other supports the table



Oliver Belt Surfacer

and backing plate on any forms and flexible pads desired. The machine will take belts up to 10 inches wide and 14 feet long. It is adjustable to various positions, vertical or inclined.

Barrel Plating Bright Zinc

A more extensive use of zinc plating for production of attractive and durable rust-resistant surfaces on a wide variety of steel articles has been made possible through development by the R. & H. Chemicals Department of the du Pont Company, Wilmington Del., of an improved barrel plating process which uses a new brightening agent. It was demonstrated publicly for the first time at the National Metals Exposition, Cleveland, October 19 to 23.

The new process is said to be particularly adaptable to use in barrel plating of building hardware, radio parts, electrical fixtures and other metal equipment where attractive appearance is important. It is said to be quite resistant to finger staining.

The product and the process have been thoroughly tested and are now being used with success by a number of commercial plating establishments. This new and brighter zinc plating is a natural extension of the process for bright zinc plating which was brought out by the du Pont Company about a year ago.

All of the practical and economic advantages of the original bright zinc plating are said to be retained in the modified method. Only small quantities of the new brightener are introduced into the regular plating solutions. No radical changes in plating practices are involved. Flat and irregular or deeply recessed steel articles are given a high uniform luster. This brighter deposit, like that obtained with the old process, also resists corrosion.

The new brightener is a liquid, easy to handle and control. In addition to being non-corrosive, it is non-inflammable and non-toxic. Consequently, it adds no complications or hazards to the bright zinc process.

Automatic Electric Salt Bath Installation

A cooperative arrangement has been effected between the Ajax Electric Company, Inc., Philadelphia, and Continental Engineers, Inc., Chicago. The Ajax Electric Company, Inc. has developed an extremely economical and low maintenance salt bath known as the Ajax-Hultgren Furnace, which may be used for liquid heat treating, case hardening or other metal heating operations. (See **Metal Industry,** August, 1936, page 311).

Continental Industrial Engineers, Inc., have developed and patented a comprehensive system which mechanically moves materials being heat treated through a predetermined cycle, as for example, preheating, heating in cyanide pots, quenching, rinsing, washing and drawing. The Ajax-Hultgren Furnace fits in ideally into the Continental System. The Continental System, it is claimed, makes possible very economical and uniform heat treating and practically eliminates handling; all operations are timed and mechanically controlled, both as to temperature and speed.

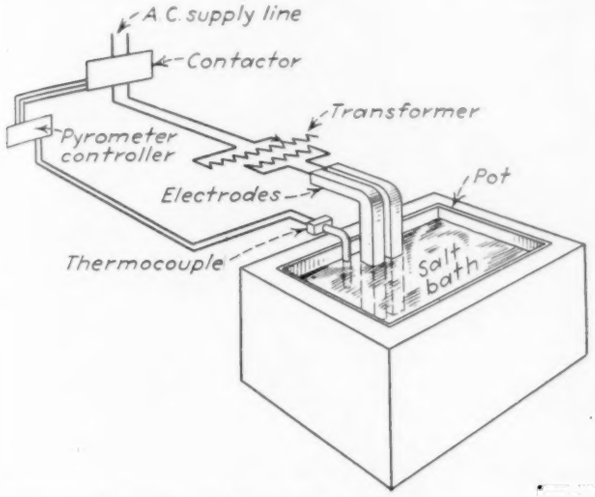
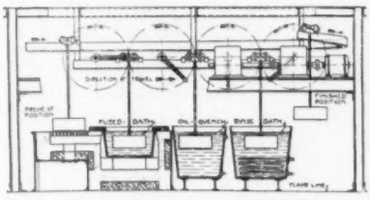


Diagram of Electric Salt Bath Installation



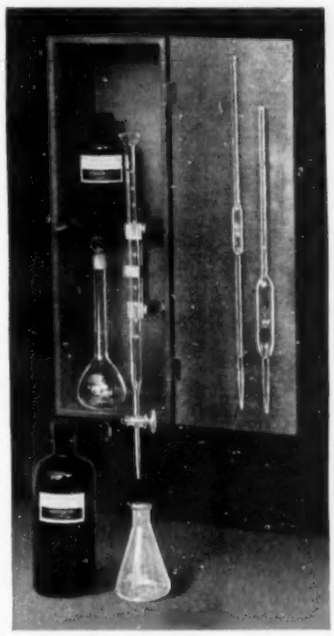
Fully Automatic Unit for Heat Treating

Analytical Set for Boric Acid Content in Nickel Solutions

Boric acid, up to now, has been a most difficult ingredient to determine in a nickel solution. To make sure that sufficient of this material was present, the average plater invariably put in more than was necessary. This was not only an expensive method, for boric acid is expensive, but sometimes led to trouble, due to its influence on the plate.

Using the set pictured here, it is stated, anyone can make an accurate test for boric acid in a very few minutes. A sample of the nickel solution is placed in a beaker with an indicator and reagent. Solution is then run into the beaker from the burette until a color change takes place. The reading on the burette is the ounces per gallon of boric acid in the solution. Direct reading—no calculations.

The set consists essentially of a 10 ml burette graduated in 1/20 ml and having a glass stop-cock, a pipette, a beaker, a bottle of standardized sodium hydroxide, a bottle of indicator solution, a jar of reagent, and directions, all packed in a handsome nickel trimmed, lock-corner box that serves as a dust tight cabinet for the entire set when not in use and as a holder for the burette when making a test.



Set for Boric Acid Analysis

Solutions and parts for the set can always be obtained from the manufacturers, The Kocour Co., 4724 S. Turner Ave., Chicago, Ill.

Flexible Polishing Wheel Cement

Flexement, sold by the J. J. Sifen Company, 1936 W. Lafayette Blvd., Detroit, Michigan, was put on the market to meet the demand for a flexible polishing wheel, set-up, medium. It is said to be the nearest to a flexible glued head on a wheel, disc or polishing belt that can be produced with any cement. It can be used with any abrasive grain or emery size, from No. 30 to flour size. No glue pots required nor heating of grain as it works in all temperatures.

Flexement is used just as it comes in 50 lb. pails without heating or thinning with a thinner. It is water soluble. According to the manufacturer it does not clog the wheel and cuts sharper than a glue set-up wheel. It is claimed that Flexement will produce 3 to 5 times as much work per set up, as wheels set up with other adhesives; it polishes any metal with no burning of wheel or discolored polished work. It is very fast drying, which reduces amount of wheels required on any polishing job.

Metal Rebuilding Process

A new metal rebuilding process used to increase the size of a worn or undersize part by applying an alloy of definite controlled crystal structure having an average hardness of 250 Brinell, has been developed by the Pyrene Mfg. Co., 560 Belmont Ave., Newark, N. J. This process called the Pyron process is recommended for the reclamation of crankshafts, motor shafts, pistons, gauges, compressed air hammer cylinders, valves, cams, etc.

The rate of deposition is said to be as high as 0.030" per hour without warping or changing in the physical characteristics of the base metal with a perfect bond, permitting any kind of machining. Rebuilt parts may be carburized and hardened in the conventional way without affecting the bond. The deposit, it is claimed, also provides an excellent base for any of the standard finishes, such as chromium, nickel, lead, tin, copper and brass.

One of the features claimed for the Pyron process is its economy. The building up of metal can be localized to the worn portions exclusively.

Improved Liquid Sulphur

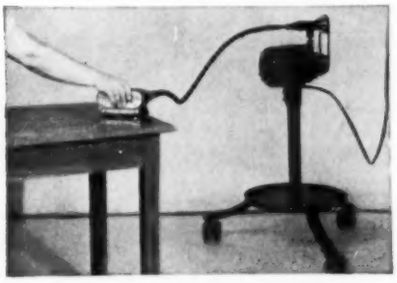
Improvements have been effected in Liquid Sulphur made by the Sulphur Products Co., Greensburg, Pa. An ingredient has been added, which it is stated, makes for continued efficiency and economy in producing oxidized

finishes on copper and silver. It also adds to the width of the variation of shades and finish, and by proper manipulation of soft wheels, it is stated, a greater variety of designs can be worked out in oxidized finishes. It is claimed that almost any shade of finish from a true blue to a blue black can be obtained by controlling the strength of the solution, temperature, number of immersions and duration of immersions.

New Electric Machine for Sanding and Finishing

For many years the desirability of an electric sanding and rubbing machine of reciprocating action has been apparent. After three years of experimental work and practical tests in a number of industrial plants the Sterling Products Company, Detroit, Michigan, presents an electric machine of this type.

This machine is driven by electric



Sterling Electric Sander

motor through a flexible shaft. It is not intended to replace the air-driven model that is manufactured by the Company, but is added as a companion to the air machine.

The sanding action is reciprocal with five-eighths of an inch travel of the sanding pad, at speeds from 1750 to 2800 complete oscillations per minute, depending upon the type of work that is to be performed. This movement duplicates the natural back and forth motion of hand sanding and rubbing.

The principle of "floating" as applied to the construction of the block is an exclusive patented feature. Flexible rollers of special composition rubber and fabric are attached floatingly by pins to the sander bloc, in addition special pads varying in flexibility are available. Due to this construction feature, there is no restriction in the movement of the block and the machine is applicable to curved and flat surfaces of metal fabric, etc. for such delicate operations as the finishing of stringed musical instruments, to the heavier production requirements of finishing machine tools, trains and auto bodies.

The machine is designed for wet or dry sanding and finishing, as a water connection is provided with a series of openings on each side of the block, providing a spray that is readily adjustable to the job requirement. For sanding with naphtha, and benzine, a special block with sterlite base is provided.

From one to five sheets of abrasive may be attached to the pad at one loading, ordinary size sheets are cut in three pieces without waste.

The machine is portable and may be operated from any electric outlet, either 110 volt or 220 volt, in the plant or outdoors. Thus the machine is applicable for finishing work of all classes and delicacy wherever hand sanding is required.

Three different types of mountings are provided: a Bench Plate Type, with motor mounted on a metal plate for use on the work bench; the Ceiling Suspended Type, in this model the motor is suspended by means of bale type handles, for use where floor space is limited; a Bench Height Pedestal Model, with three leg caster base, facilitating the moving from one department to another.

Frequent oiling is not required, as sufficient grease is contained for one to six months' operation.

It is stated that perfect balance of the sander head and the light weight of seven and one-half pounds plus the compact dimensions of 7" long by 4¾" high and 3¾" wide, provide a comfortable fit to the palm of the hand, besides making the machine extremely responsive

Patented "Floating Block"

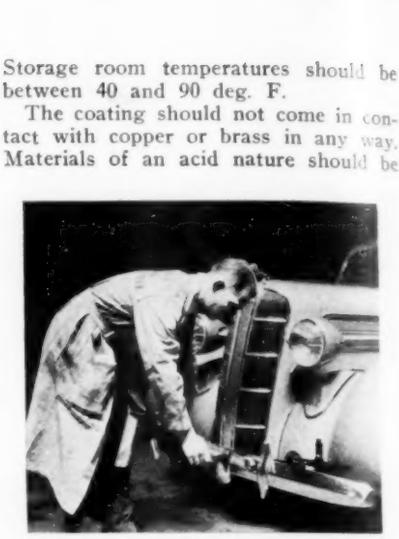
to the guidance of the operator in any position.

Temporary Protective Coating

Protex is a material developed by American Anode, Inc., 60 Cherry St., Akron, Ohio, for the purpose of temporarily protecting objects from surface injury during manufacture, storage or shipment. Metal products with special finishes and easily marred surfaces, can be covered with Protex which, it is stated, is easily applied and easily removed.

Protex is a rubber latex, an easy flowing metallic liquid containing a certain amount of water but no inflammable solvents. It can be used as a dip, as a spray (with specially developed spray gun) and also by brushing. It can be stored in black iron, stoneware, aluminum or stainless steel containers. Storage room temperatures should be between 40 and 90 deg. F.

The coating should not come in contact with copper or brass in any way. Materials of an acid nature should be



Removing Protex Coating

kept away from liquid Protex. Four different types are made to cover a wide variety of purposes for which it is recommended.

Improved Spray Nozzles for Descaling Service

A new spray nozzle for descaling strip, plate, and bar steel has been developed by Worthington Pump and Machinery Corporation of Harrison, New Jersey.

The nozzle consists of a stainless steel body, a tapered self-locking spray disc of heat treated stainless steel and a strainer of corrosion resisting material. Disc and strainer are held in place by a cap nut of stainless steel. They may be removed for cleaning without disturbing the nozzle body in the spray manifold.

The nozzle may be had with a shut-off cap, which effects savings in water and power when rolling narrow strips.

The one piece disc contains an elliptical orifice designed to give uniform linear spray distribution and maximum impinging force. The disc is furnished in three sizes capable of dis-

Descaling Nozzle

charging up to 35 gallons per minute at pressures up to 1000 pounds per square inch.

Descriptive bulletin obtainable on request to the manufacturer, illustrates these nozzles in detail, with tables of dimensions and capacities for all sizes. Also illustrated, are several types of high pressure pumps built by Worthington for descaling service.

Conveyorized, Three-Dip Detrex Degreaser

The large three-dip degreaser illustrated is a recent addition to the complete line of standard and special machines manufactured by Detroit Rex Products Company, 13005 Hillview Ave., Detroit, Mich.

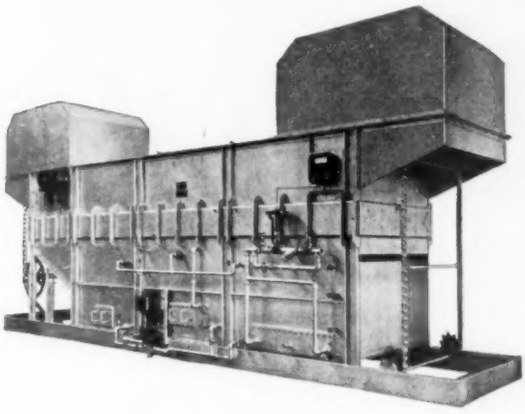
This machine, which is designated as Model 3DC-650, consists of three chambers which are separated by two wide overflow dams. It is equipped with a two-strand, cross-rod type conveyor, and a variable speed drive.

The cycle of cleaning operations in this automatic degreasing machine is: first, immersion in boiling solvent; second, immersion in solvent distillate rinse; and third, immersion in pure solvent vapors. The work is placed in baskets which are hung from the conveyor cross rods, and thus conveyed through the machine. The work comes cut perfectly dry and clean—ready for subsequent finishing operation.

The steam coils for heating the solvent are located in the first chamber shown at the right end of the machine. An air operated, steam actuated thermostat control is used for automatic temperature regulation.

The machine is completely hooded and designed so that the natural solvent loss is less than ½ gallon per hour. The water-jacket condenser completely encircles the machine, and there is a solvent distillate collecting trough inside directly beneath the condenser zone. The motor-driven pump shown in lower left center of photograph transfers the solvent between any chambers desired.

The solvent used in Detrex Degreasers is either Perm-A-Clor or Triad, which are non-inflammable and non-explosive safety solvents.



Detrex Model DC 650 Degreaser

Priming Vehicle for Aluminum Paint

Penetrol is the trade name of a vehicle made by the Flood Company, 6217 Carnegie Ave., Cleveland, O., for aluminum paint, which it is stated, has exceptional advantages because of its retarded set-up, its elasticity; its hard bottom-drying, its penetration and its adherence to undercoats. It is claimed that Penetrol gives a uniform, hard cohesive and homogeneous film all the way through, eliminating the danger of breakdown action, which might be caused by differences in the co-efficients of expansion and contraction between dissimilar films. It gives perfect "leafing."

Over porous surfaces a priming coat of clear Penetrol should first be applied in order to penetrate and thoroughly seal the surfaces. The aluminum paint with Penetrol as a vehicle can then be used to cover this primer as a final coat.

One gallon of Penetrol plus 1¾ pounds of the aluminum paste manufactured by this company, makes approximately 9 pints of aluminum paint.

Acme Colored "Superstrip" Strip Steel

Acme Steel Company, Chicago, announces Acme Colorstrip—cold rolled strip steel in colors. Practically all colors and shades can be reproduced, it is stated. Particularly stressed is that the small extra cost of this attractive lacquered strip steel is only a fraction of the cost to produce the same effect on the product after forming.

Acme Colorstrip will, it is claimed, withstand bending, drawing and forming.

Bench Gas Furnaces

The new small, handy, modern bench gas furnaces, illustrated below are designed to solve a surprising number of production problems.

The small oven furnace, operated without air blower, heat treats small metal parts at temperatures up to 2000 deg. F. The small pot type metal melting furnace, operated without air blower, melts a 30 lbs. charge of aluminum in one hour or 160 lbs. of lead in half that time. The soldering furnace is said to give longer life to soldering coppers and to speed up the soldering operation. The following advantages of this equipment are stressed:

1. They save fuel, time and labor in handling small processing jobs and repair work.

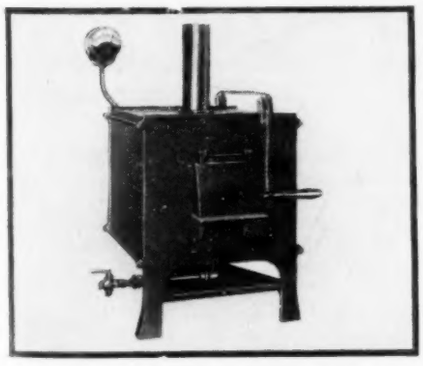
2. They can be used for small work instead of heating up large furnaces.

3. They can be installed at little cost, since no air blower or air pipe connection is necessary.

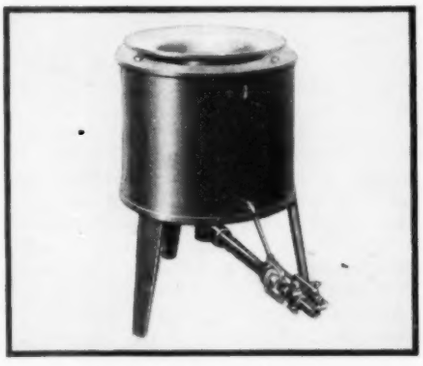
4. They give quick, uniform heat at all times.

5. They are ruggedly built to give long, efficient service.

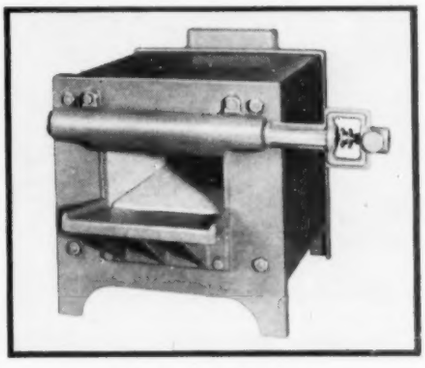
Full information can be obtained from the Industrial Gas Division, Consolidated Gas Co. of New York, Inc., 4 Irving Place, New York.



Small Soldering Furnace



Small Melting Furnace



Small Oven Furnace

Furnace for Porcelain Enameling

The new type porcelain enameling furnace recently perfected by the Surface Combustion Corporation is of the gas-fired radiant tube type. It was tested thoroughly by the American Gas Association in the plant of a large range manufacturer and by engineers of the Ferro Enamel Corporation in their plant at Cleveland, Ohio and the results proved satisfactory. Installation of new furnaces and conversions of old furnaces into the new type are being handled exclusively, in the porcelain enameling industry, by the Ferro Enamel Corporation of Cleveland, Ohio.

This furnace is heated by hair-pin shaped alloy tube elements placed on the hearth and sidewalls. (See cross-sectional drawing). The gas burns in the tubes to almost perfect combustion, with a non-turbulent flow of flame, never coming in contact with the ware being fired. The tubes are under negative pressure; thus contamination of the firing chamber atmosphere by combustion gases is eliminated.

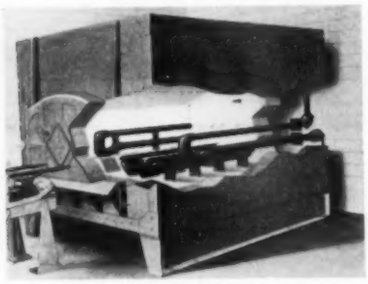


Fig. 1. Cross-Sectional View of new Radiant Tube Turnace

By arrangement of the tubes, uniform temperature distribution and accurate heat control are said to be easily maintained. In the event of failure of one of the tubes, it can be easily repaired or replaced without a prolonged shutdown of the furnace.

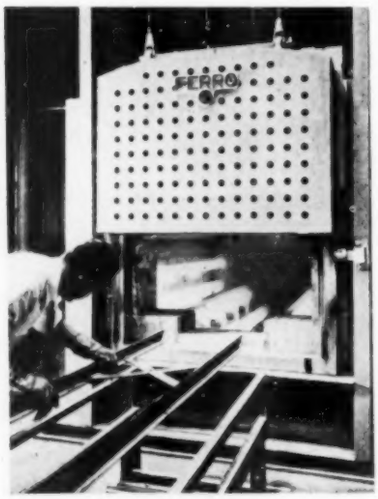


Fig. 2. Rear End View of furnace showing burner and exhauster equipment

Installation of a complete new furnace is recommended, but any ordinary box-type porcelain enameling furnace may be converted to gas radiant tubes with only a few alterations. The initial cost is somewhat high, but the lower operating cost and improved quality of

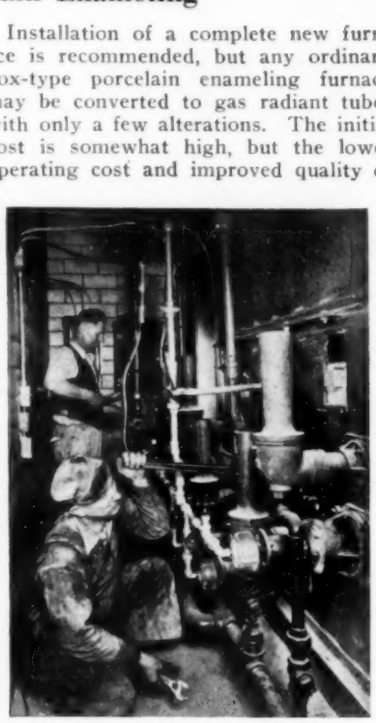


Fig. 3. Looking Into the New Radiant Tube Porcelain Enameling Furnace. Tubes installed along sides and bottom of hearth; ware burned directly on the tubes.

ware produced will, it is claimed, in practically all cases more than warrant the investment involved.

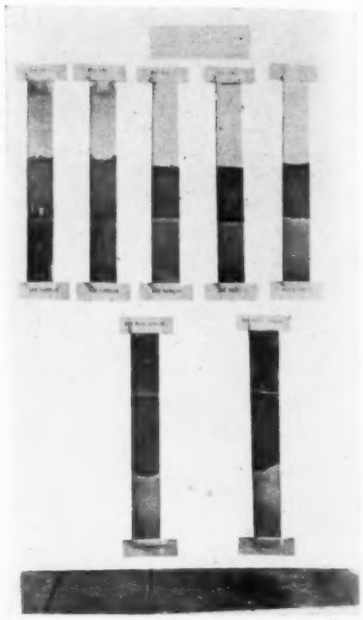
Corrosion Inhibitors

The advent of special bearings in the automobile industry, such as copper-lead, cadmium-silver, etc., has brought to light the problem of the corrosive action of the oils used on these bearings.

The Alox Corporation, P. O. Box 564, Niagara Falls, N. Y., has developed a number of compounds for addition to lubricating oils to prevent or reduce the attack on the bearings. These "oiliness" compounds are stated to be particularly suited for use under high engine speeds, high operating temperatures, high compression, etc. They are also said considerably to improve lubricating ability of modern oils.

Rust Preventives

Other compounds manufactured by the above company are said to show unusual corrosion-inhibiting qualities on metals exposed to corrosive atmospheres, such as salt air, in chemical plants, etc. The illustration shows a number of metal strips coated on one end with Alox materials and on the other end with varying amounts of more commonly known rust-inhibitors. It will be noted that as little as 5% of the Alox product in a solvent gave better resistance to corrosion than 20% of a good grade of Lanolin in the same solvent. These strips were exposed to a hydrochloric-nitric acid atmosphere for



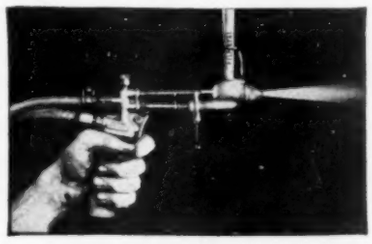
Metal strips showing comparative resistance of Alox and other rust inhibitors

72 hours and then to open air for 90 days.

In this connection, tests by various Government Bureaus have shown where Alox materials were used no corrosion was detectable after 18 months exposure whereas with competitive products very bad rusting was manifested in a few weeks.

Solder Spray Gun

A new type of metal spray gun is being distributed by the Metallicoat Syndicate, Chamber of Commerce Bldg., Long Island City, N. Y., called the Ace Turnhead Gun. It is stated that this gun fills dents at much lower cost than by the old-fashioned hand soldering method, and also does tinning in the same rapid and inexpensive style.



Ace Turnhead Gun

It is operated by acetylene and air—acetylene at 5 to 10 lb. pressure and the air line at 40 lb. pressure. Oxygen at 25 lb. may be used if more convenient.

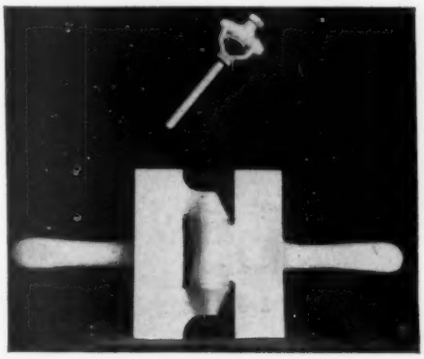
It can be changed from a spray gun to an acetylene torch simply and rapidly. The primary application for this type of equipment is in repair work in which it is stated, it saves the time and labor of disassembling and reassembling.

New Type Joint

The Hines Manufacturing Co., Cleveland, Ohio, has just patented a new joint for all types and sizes of hinges, to knuckle joints for all purposes and to endless chains of all sizes and materials. It is claimed that this joint is absolutely tight, dust proof and water proof which adapts it for use under water on sea going vessels. It is practical to die cast or sand mold these joints as desired.

Outstanding advantages claimed are the extreme tightness, accuracy, smoothness of operation and low cost. Cost of hinges or joints made by this process is said to be no more than the cost of commercial castings or other materials from which they are made. Joints are completely finished and ready for use as they come from the dies or molds.

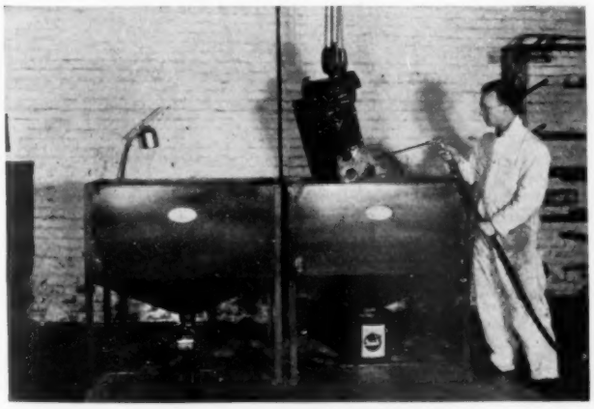
Applications for hinges and joints of this type include boats, automobiles, all kinds of machinery, building hardware, etc. The inventors plan to license various companies to operate under their patent which has already been granted.



Hines Knuckle Joint

The Hydro-Degreaser

Developed by the Curran Corp., Malden, Mass., for removing heavy accumulations of oil and grease from airplane engines and parts, the Hydro-Degreaser is said to have been found particularly adapted for economical operation in large industrial plants, jewelry manufacturers and screw machine works. It has no toxic vapors and requires no heat or steam for its use. The Gunk solvent compound used as the cleaning medium in the Hydro-Degreaser has, it is claimed, a powerful affinity for waxes and buffing compounds and will remove the last trace of them without injury to aluminum, magnesium, or other soft metals.



Curran "Dunk and Rinse" Tank

It is stated by the manufacturers that oil-coated and greasy metal parts may be effectively degreased by cold immersion in a Gunk solution contained in one compartment of the Hydro-Degreaser. After soaking for a few minutes, the parts are then removed from the Gunk bath to a rinse section of the Hydro-Degreaser where they are slucied off with a water hose, which quickly emulsifies the treated grease, leaving a perfectly clean, dry surface without oily film.

If necessary, air line agitation is used to create turbulence of the solvent bath to reduce the time necessary for emulsion to only a minute or two. The rinse section of the Hydro-Degreaser is connected directly to the sewer drain and carries off the dissolved oils and greases in a safe emulsion form, the tank being self-cleaning and the process continuous.

The makers claim that the Hydro-Degreaser entirely eliminates costly steam or gas heat, and that the Gunk solution has the safety feature of being non-corrosive to the skin, requiring no special protection.

Tin Plating Machine

A machine for the tin plating of cast iron pistons and for a wide variety of other small metal parts is announced by the Circo Products Co., 3088 W. 106th St., Cleveland, Ohio. This machine features a new power unit and a new bath at lower unit cost, including first cost, operating current and labor cost.

This unit, it is stated, dispenses with the need for a usual motor and generator. It is connected to the regular 110 volt, 50 or 60 cycle, A.C. line. Passing through the Powr-Pak, the current is changed to the current necessary for the tin plating bath.

The following advantages are claimed:

Laboratory analysis rarely needed.

Usual tin anodes not required.

Operates continuously with solution at 150 deg. F.

Unusually good throwing power; uniform deposit; firmly adherent.

The machine will plate one set of any standard automobile pistons at one time, the length of time depending upon the size of the piston. For example it is stated that one set of six Chevrolet pistons can be plated in 45 minutes. General rate of deposit is said to be 0.001" per hour.

Adaptable to a wide variety of other metal articles.

Flux for Soldering Aluminum Cast Iron, Etc.

Of interest to solder and flux users is the new flux developed by the Alumaweld Company of America, 2442 South Park Way, Chicago, Illinois. This new flux, used in conjunction with a special solder, it is claimed, does a job heretofore considered impossible.

With Alumaweld flux it is now said to be possible to make high strength, permanent repairs on joints of any metal. Alumaweld Solder and Flux is applied with an ordinary soldering iron or blow torch. The soldering job is done at a low temperature, but it is stated, requires high temperatures to melt it a second time. It is recommended for aluminum, stainless steel, die cast pot metal, cast iron, copper, brass, etc. and for joining any two different metals if desired.

Alumaweld flux can be used with any type of solder, but when greater tensile strength is desired, the use of Alumaweld solder is recommended. Alumweld solder is said to have a tensile strength of 12,000 pounds. Also that the finished joint can be worked or machined and takes a polish over which chromium or any other plating can be applied.

Scientific Research Institute

The Scientific Research Institute, 1965 Porter St., Detroit, Mich., has been organized to provide scientific tests and the approval of advertisers' products for the guidance of consumers. They will supply an emblem which will denote adequate standards in materials and quality, which are in most cases already met by reliable producers. Manufacturers who are awarded the emblem are accorded the right to reproduce the emblem on their products and in their advertising, subject, however, to periodical checks made by the Institute to ascertain continuance of standards found on the original examination.

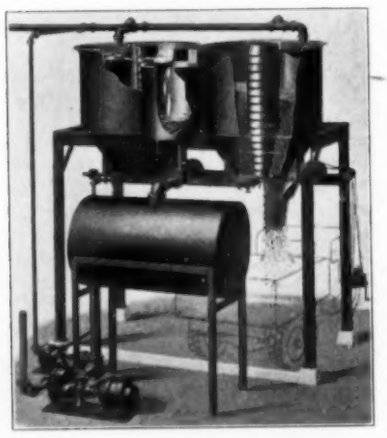
Dewatering Tanks

The Claude B. Schneible Company, Chicago, Ill., announce a complete line of dewatering tanks for use with wet dust collector units.

This new equipment known as the Schneible Multi-Louver Dewatering Tank is a specially designed unit for dewatering the accumulated sludge in the settling cone of Multi-Wash Dust Collectors. It has no moving parts other than the discharge gates and it is stated, requires no care or attention other than the opening and closing of the valves, and opening of the gates in the discharging of the solids.

The method of operation is simple. Water containing solids enters the dewatering tank at the top through a baffled section which prevents undue disturbance of the water in the tank. A constant level is maintained in the tank at all times, the excess water flowing over a weir on the opposite side of the tank from the inlet. The overflow water enters a surge tank from which it is re-circulated in the dust collector system.

The low velocity of the water in the tank allows for complete precipitation of the solids in the area around the Multi-Louver Cone in the center of the tank. When the tank is sufficiently filled with precipitated material, the inflow water is switched to another tank in the dewatering unit. After a short precipitation period, a valve on the line leading to the interior of the Multi-Louver Cone is opened, and the head of water in the draining tank is allowed to recede slowly. The water flows out of the precipitated material and does not carry the material with it due to the angle of repose of the material against the Multi-Louver cones in the center of the tank. The final draining period will reduce the moisture contained in the sludge down to about 20%, depending on the absorbent qualities of the material. When the sludge in the dewatering tank is completely drained, the bottom gates are dropped to allow the material to fill into a truck, railroad car, or other convenient receptacle.



Multi-Louver Dewatering Tank

Approved Respirators

Two types of dust respirators made by the Pulmosan Safety Equipment Corp., 176 Johnson St., Brooklyn, N. Y., have been approved by the U. S. Bureau of Mines. These respirators are designated as M-1100 and L-2100

Both respirators are recommended for extra heavy duty. The main body is constructed of pressed aluminum to which is attached the patented non-inflated cushion compounded of non-irritating, non-toxic rubber. Other features are all-rubber adjustable headbands attached by swivel joint; pouch filter, and a positive exhaust valve.

Respirator L-2100 is recommended especially for lead dusts.

Respirator L-2100 for Lead Dusts

New Catalogs

Industrial Oils, Greases, Cleaners; Beacon Brand products. J. W. Kelley Co., 13209 Athens Ave., Cleveland, Ohio.

Kelkut Grinding Oil. J. W. Kelley Co., 13209 Athens Ave., Cleveland, Ohio.

Vim Short-Center Drives; with Vim Tred leather belting. E. F. Houghton & Co., Philadelphia, Pa.

Metal Stampings in Small Lots. A nation-wide service. Dayton Rogers Mfg. Co., Minneapolis, Minn.

Research Metallographic Equipment. A complete co-ordinated outfit for visual and photographic work. Bausch & Lomb Optical Co., Rochester, N. Y.

Low Power Photomicrography. Bausch & Lomb Optical Co., Rochester, N. Y.

Electric Furnaces. Bulletin 10, superseding Bulletin 7; includes information on oscillator or spark-gap type converters and furnaces; also the new 60-pound tilting furnace for melting non-ferrous and precious metals. Ajax Electrothermic Corp., Trenton, N. J.

Foundry Equipment. Complete and partial installations for large and small non-ferrous and ferrous foundries; sand handling and sand conditioning equipment; mold conveyors and accessory foundry equipment. C. O. Bartlett & Snow Co., 6200 Harvard Ave., Cleveland, Ohio.

"Wherever Heat is Used in Industry." Furnaces and accessories for all types of fuels and heating work. Surface Combustion Corp., Toledo ,Ohio.

Electric Drills, Grinders-Buffers, Portable Tools. Catalog No. 27. Cincinnati Electrical Tool Co., Division of the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio.

General-Purpose Squirrel-Cage Induction Motors. General Electric Co., Schenectady, N. Y.

Splashproof Induction Motors, General Electric Co., Schenectady, N. Y.

Explosion-Proof Totally Enclosed, Fan-cooled Induction Motors. General Electric Co., Schenectady, N. Y.

Type K Totally Enclosed Induction Motors. General Electric Co., Schenectady, N. Y.

Totally Enclosed Fan-cooled Induction Motors. General Electric Co., Schenectady, N. Y.

Dry Rectifiers. Booklet B-2078. Rectox copper oxide rectifiers for changing from a-c to d-c without moving parts or chemical reaction. Westinghouse Electric and Mfg. Co., E. Pittsburgh, Pa.

The Properties and Applications of Heat Treated Wrought Nickel Alloy Steels; (in sections up to about 6 inches in diameter or thickness). Bulletin-P-1. International Nickel Co., 67 Wall St., N. Y.

Embossed Metal Foils. Booklet 362. Reynolds Metals Co., 19 Rector St., N. Y.

Orthosil. For heavy duty metal cleaning; for detergent purposes. Pennsylvania Salt Mfg. Co., Widener Bldg., Philadelphia, Pa.

The Answer to Rolling Mills Bearing Problems. Timken Roller Bearing Co., Canton, Ohio.

British technical books, reduced price chemical texts, laboratory colloid mill, hand homogenizer, low priced stirrer, pyrometer, sample storage set and luminous paint kit. Chemical Publishing Co. of N. Y. Inc., 149 Lafayette St., New York.

Airoline Air Operated Controllers. Catalog No. 8901. Brown Instrument Co., Philadelphia, Pa.

Udylite Service. For every plating and polishing requirement; buffing and polishing wheels, compositions, generators, plating rheostats, ball anodes, semi-automatic and full automatic plating machines; plating barrels, salts and chemicals. The Udylite Co., 1651 E. Grand Blvd., Detroit, Mich.

"Does Unionism Really Benefit Labor?" Farrel-Birmingham Co. Inc., Ansonia, Conn.

Scientific Metal Cleaning. Applications and advantages of Detroit Degreasing called Perm-A-Clor or Triad Safety Solvents, and Triad Alkali Cleaning Compounds and Strippers. Detroit Rex Products Co., 13005 Hillview Ave., Detroit, Mich.

Flexible-Shafts and Equipment; their selection, uses and care. Swartz and White Mfg. Co., 243 Water St., Binghamton, N. Y.

Dixon Stoppers, Nozzles-Sleeves; graphite. Joseph Dixon Crucible Co., Jersey City, N. J.

"Seven Reasons Why You Should Buy a Lewis Roe Polishing Lathe." Models No. 1, 2 and 3. Lewis Roe Mfg. Co., 1050 De Kalb Ave., Brooklyn, N. Y.

"You Run the Test in Your Own Plant; Then Decide About Solvent Degreasing." Detroit Rex Products Co., 13001 Hillview Ave., Detroit, Mich.

Scientific Metal Cleaning; solvent degreasing and alkali cleaning. Detroit Rex Products Co., 13007 Hillview Ave., Detroit, Mich.

"Built Together" Pumps; Figure 5550 type. Fairbanks, Morse & Co., Chicago, Ill.

Electric and Belt Driven Grinders, Polishing Machines and Countershafts. Catalog No. 7. Clizbe Bros. Mfg. Co., Plymouth, Ind.

Blast Cleaning Room Equipment. Bulletin No. 35. Ruemelin Mfg. Co., 3860 N. Palmer St., Milwaukee, Wisc.

Facts About Metal Polishing. Norton Co., Worcester, Mass.

Methods for the Application of Sodium Cyanide Solutions in the Preparation of Metal Surfaces. A manual giving a general outline for the various metals used with specific information regarding the use and handling of sodium cyanide; steel finishes, metal surfaces, direct application of sodium cyanide, cleaning non-ferrous metal surfaces, preparation of steel surfaces for enameling, preparing metal surfaces, and safe handling of sodium cyanide. R & H Chemicals Dept. E. I. duPont de Nemours & Co., Wilmington, Del.

"The Key to More Sales and Bigger Profits." Pre-finished metals. American Nickeloid Co., Peru, Ill.

Chemicals by Glyco. A booklet containing a number of interesting additions to previous editions including suggested formulae for many different industries such as emulsifying agents, etc. Glyco Products Co., Inc., 148 Lafayette St., New York City.

Atlas Explosives: explosives, blasting caps, electric blasting caps, delays, squibs and all blasting accessories. Atlas Powder Co., Wilmington, Dela.

"Isolation." A publication devoted to the study of soundproofing and the isolation of machine vibrations. Vol. 5 No. 1. Korfund Co., Inc., Long Island City, N. Y.

The Conquest of Weight. The Budd system of lightweight construction using stainless steel. Edward G. Budd Mfg. Co., Philadelphia, Pa.

Testing Machines: Hardness Testing Hammer, Type P; "Superior" Universal Hydraulic Testing Machine; "Superior" Ductility Testing Machine; Proving Instrument; Tensile Testing Machine. Steel City Testing Laboratory, 8843 Livernois Ave., Detroit, Mich.

American Line of Flasks and Jackets. Booklet No. 551. Information on featherweight Dow metal flasks, aluminum flasks, steel plate, pouring jackets, flexible aluminum pouring jackets and flexible cast iron pouring jackets. American Foundry Equipment Co., 408 Byrkit St., Mishawaka, Ind.

American Dustube Dust Control Data Book. A new 24-page data book No. 22 devoted to description, illustration and drawings of the American Dustube dust collector and describing its application to dust control problems. American Foundry Equipment Co., 408 Byrkit St., Mishawaka, Ind.

Tongs of Every Description. A complete price list illustrated in full detail. J. Goebel & Co., 95 Bedford St., New York.

Things You Should Know About Your Roof. Johns-Manville Corp., 22 E. 40th Street, New York.

Coupled Pumps. Bulletin No. 7066; capacities from 150 to 5,000 gallons per minute against heads between 20 and 250 feet; for nearly all liquids, chemicals, etc. Ingersoll-Rand Co., 11 Broadway, New York.

The New Arc Welding Technique; Lincoln "Shield-Arc SAE" Welder. The Lincoln Electric Co., Cleveland, Ohio.

Annealing in Controlled Atmospheres. Practical points on installing and operating bright annealing equipment and atmosphere control. Continental Industrial Engineers, Inc., 201 N. Wells St., Chicago, Ill.

Cornell Rolling Doors; for industrial plants, office buildings, institutions, etc. Cornell Iron Works, Inc., 36th Ave. & 13th St., Long Island City, N. Y.

Compressed Air at Lower Cost. Worthington Feather Valve Compressors. Worthington Pump and Machinery Corp., Harrison, N. J.

Centrifugal Pumps Arranged for Automatic Priming. Worthington Pump and Machinery Corp., Harrison, N. J.

Continuously Smelted Frits; higher degree of uniformity than batch type smelted material. The Porcelain Enamel & Mfg. Co., Baltimore, Md.

Added Service for Executives, Superintendents and Foremen Platers. An efficient modern laboratory for solution analyses and plating room tests to help solve cleaning problems. MacDermid, Inc., Waterbury, Conn.

Grade "R"—the Metal Cleaner for Industrial Use; for the removal of buffing compounds, for use as an electric cleaner and for use prior to japanning and enameling. MacDermid, Inc., Waterbury, Conn.

Anodes and Plating Chemicals. A description of all kinds of anodes and chemicals for plating; also a brief description of the H-VW-M bright nickel plating process and the Mazic bright zinc plating process. Hanson-Van Winkle-Munning Co., Matawan, N. J.

Electric Heating Cartridge Units, also shell heating units, electric tubular heating units and caterpillar heating units. Harold E. Trent, Co., 618-640 N. 54th St., Philadelphia, Pa.

Coordinated Control System. Bulletin 460T describing a new system of complete process control. Bristol Co., Waterbury, Conn.

Acme Steelstrap; method of lowering handling costs by the "Skid Idea." Acme Steel Co., 2840 Archer Ave., Chicago, Ill.

Stevens Buffing Compositions. A new illustrated booklet on buffing compositions and metal finishing equipment, describing in detail, Stevens buffing compositions and their applications, Stevens Zucker Pioneer rouges and applications and the Mitchell line of motor driven polishing lathes and automatic polishing and buffing machines.

Associations and Societies

Copper and Brass Research Association

420 Lexington Ave., New York

"There has been a marked increase in the consumption of products made from copper and its alloys during the first nine months of this year, and the outlook for the fourth quarter is most encouraging," **F. S. Chase,** President of the Copper & Brass Research Association, announced October 15th at the 15th annual meeting of members. "Present indications," he said, "point to the tonnage for 1937 exceeding that of the present year by most consuming industries.

"The largest tonnage of copper is, of course, used in the electrical field. The mileage of rural lines being built this year will more than double that of 1935 and the sale of all electrical appliances exceeds that of any year since the depression was first felt.

"Next to the electrical the automobile industry is the largest consumer of copper and its alloys. During the present year the sale of pleasure cars and trucks will likely reach 4,500,000. The record sales by that industry was in 1929 when 5,621,715 cars and trucks were sold. The next best year was 1928 when the total sales aggregated 4,601,000. The latter figure may be exceeded by a half million cars and trucks in 1937.

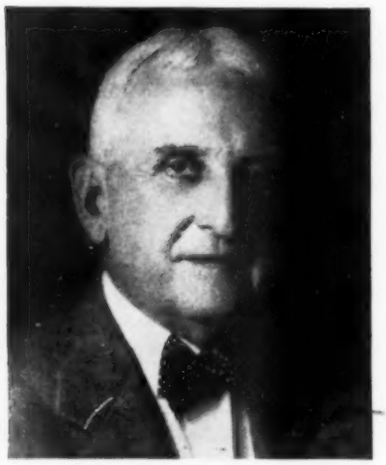
"More than 200,000,000 pounds of copper and its alloys will be consumed in the automobile field this year for new construction and for necessary repairs to cars and trucks.

"In normal times the building industry is as large a consumer of copper, brass and bronze as is the automobile industry. The long-awaited and hoped-for building boom is just getting in its stride. Our own industry will sell perhaps 10,000,000 more pounds of brass pipe and copper tubing for water lines than in any previous year in the history of the manufacture of those materials.

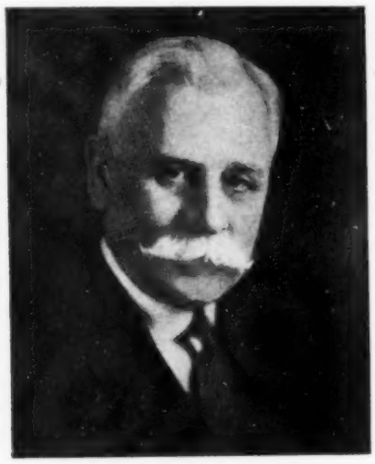
"The outlook for considerable increase in the volume of building in 1937 over 1936 is bright with the result that the consumption of all better building materials will show considerable increase.

"A new all-time sales record will be established this year by the oil burner industry. In 1928 that industry consumed some 250,000 pounds of copper in the installation of burners. This year the tonnage will exceed 5,500,000 and in 1937 will show a substantial further increase.

"Sales of giftware articles and other specialties are good. Orders for the holiday season in these lines are better than they have been for any year since the post-war years."



F. S. CHASE
President



JOHN A. COE
Vice-President

C. D. DALLAS
Vice-President

The following officers of the Association were elected:

President — F. S. Chase, President of Chase Brass and Copper Company, Inc.

Vice-President—John A. Coe, President of The American Brass Company

Vice-President—C. D. Dallas, President of Revere Copper and Brass Incorporated

Vice-President—Wylie Brown, President of Phelps Dodge Copper Products Corporation

Treasurer—C. D. Dallas, President of Revere Copper and Brass Incorporated

Secretary—Bertram B. Caddle.

Following are those elected to the Executive Committee: **J. A. Doucett,** Revere Copper and Brass Incorporated; **R. L. Coe,** Chase Brass & Copper Company; **John A. Coe, Jr.,** The American Brass Company; **Wylie Brown,** Phelps Dodge Copper Products Corporation; **W. M. Goss,** Scovill Manufacturing Company; **H. W. Steinkraus,** Bridgeport Brass Company.

WYLIE BROWN
Vice-President

B. B. CADDLE
Secretary

The Board of Directors elected include the members of the Executive Committee and the folowing: **F. S. Chase,** Chase Brass & Copper Company; **C. D. Dallas,** Revere Copper and Brass Incorporated; **John A. Coe,** The American Brass Company; **R. E. Day,** Bridgeport Brass Company; **E. O. Goss,** Scovill Manufacturing Company; **J. P. Lally,** C. G. Hussey & Company; **C. C. Limbocker,** Wolverine Tube Company; **H. A. Staples,** Phelps Dodge Copper Products Corporation; **F. L. Riggin,** Mueller Brass Company, and **Bertram B. Caddle,** Secretary of the Copper & Brass Research Association.

American Foundrymen's Association

222 W. Adams Street, Chicago, Ill.

Milwaukee, one of the foremost foundry centers in the United States, has been selected for the 41st Annual Convention and Exposition of the American Foundrymen's Association, to be held during the week of May 2, 1937. The meetings and display of equipment and supplies will be staged in the Milwaukee Auditorium.

Milwaukee is eminently suited for the activities planned, and is accessible by rail, automobile, air and water transportation. Hotel accommodations have been greatly expanded since the last previous American Foundrymen's Association Convention held in that city in 1924. The Auditorium, often cited as a model of such structures, and located within walking distance of the business and hotel section of the city, has full facilities for technical and committee meetings and for exhibits of equipment and supplies used in the foundry industry.

Shaping the program and exhibition to meet the present day needs of the industry, special attention will be given to new technical and mechanical developments. Papers on all phases of foundry practice and on management problems will be offered, with special attention being given to the medical and legislative aspects of Safety and Hygiene in the foundry. In addition, papers have been scheduled on the use of safety shoes, leggings, goggles and respiratory protective devices and on maintenance of equipment. This part of the problem of foundry management today, will be found supplemented by a special section in the exhibition devoted to protective equipment.

Iowa Foundry Conference

A two-day Foundry Conference was held by the Engineering College of the University of Iowa, Quad City Chapter of American Foundrymen's Association, and the Northern Iowa Foundrymen's Association, at Iowa City, October 30 and 31st.

The Conference included papers and sessions on sand control, the testing of cast metals and non-ferrous foundry practice.

American Electro-Platers' Society

90 Maynard Street, Springfield, Mass.

The 1937 Convention of the A.E.S., the 25th Annual Convention and Silver Jubilee will be held at New York, June 14, 15th, 16th and 17th at the Hotel Pennsylvania, 34th St. and 7th Ave., directly opposite the Pennsylvania R.R. Station. After twenty-five years the New York Branch is glad to have the Convention home again where the Society was founded.

For all information write to: **Franklyn J. MacStoker,** General Chairman, 25 Princeton Street, Garden City, N. Y. or the Committee Chairmen named below:

Publicity Committee—Louis H. Cates, 645 Ocean Parkway, Brooklyn N. Y.

Program Committee — Ralph J. Liguori, 2429 Hubbard St., Brooklyn, N. Y.

Educational Committee—John J. Rolff, 117-30 168th St., Jamaica, N. Y.

Hartford Branch, A. E. S.

c/o Vernon E. Grant, 18 Birge Road, Bristol, Conn.

Rubber as applied to the plating industry will be the subject of a meeting to be held by the Hartford Branch of the American Electro-Platers' Society inn the auditorium of the State Trade School, Hartford, Connecticut, November 9.

Dr. H. H. Harkins, Development Department, United States Rubber Products, Inc., and **O. S. True,** Manager, Chemical Industries Tank Lining Sales, United States Rubber Products, Inc., will be the chief speakers.

The rapidly growing use of rubber in this highly specialized field has focussed the interest of the key men in the industry on the subject. It is expected that the meeting will further stimulate the use of rubber in the plating industry.

The **Storts Welding Co.,** of Meriden, Connecticut, in cooperation with the Hartford Branch arranged the meeting.

North Jersey Non-Ferrous Founders Association

The October meeting of the North Jersey Non-Ferrous Founders' Association was held on Thursday, October 22, at the Essex House, 1048 Broad St., Newark. Dinner was served at 6:30 P. M.

L. A. Behrend, superintendent of the American Crucible Co. of Shelton, Conn., spoke on "Crucibles." He described the chemical composition and process of manufacture and their effect on the life of crucibles and how proper treatment in the foundry can materially increase their average life.

Porcelain Enamel Institute

612 N. Michigan Ave., Chicago, Ill.

The Sixth Annual Meeting of the Porcelain Enamel Institute was held on October 1st and 2nd, at the Statler Hotel, Cleveland, Ohio. The following officers were unanimously re-elected for 1937:

R. G. Calton, vice-president, **Tennessee Enamel Mfg. Co.,** Nashville, Tenn., president; **E. L. Lasier,** vice-president, **Titanium Alloy Mfg. Co.,** Niagara Falls, N. Y., vice-president; **F. E. Hodek, Jr.,** secretary treasurer, **General Porcelain Enameling & Mfg. Co.,** Chicago, Ill., vice-president; **W. Hogenson,** president, **Chicago Vitreous Enamel Products Co.,** Cicero, Ill., treasurer, and **G. P. MacKnight, Porcelain Enamel Institute,** Chicago, secretary.

Members of the Executive Committee for 1937 were re-elected as well. In addition to the officers, with the exception of the secretary, the committee will consist of: **Jobbing Shop Division—Louis Ingram,** president, **Ingram-Richardson Mfg. Co.,** Beaver Falls, Pa.; **E. S. Smith,** president, **Toledo Porcelain Enamel Products Co.,** Toledo, Ohio; **Table Top Division—W. H. Brett,** secretary, **Enamel Products Co.,** Cleveland; **R. W. Staud,** sales promotion manager, **Benjamin Electric Mfg. Co.,** Des Plaines, Ill.; **Sign Division—G. S. Blome,** vice-president, **Baltimore Enamel & Novelty Co.,** Baltimore, Md.; **F. E. Hodek, Jr.,** secretary-treasurer, **General Porcelain Enameling & Mfg. Co.,** Chicago; **Frit Division—W. R. Greer,** vice-president, **Porcelain Enamel & Mfg. Co.,** Baltimore, Md.; **R. A. Weaver,** president, **Ferro Enamel Corp.,** Cleveland; **Cooperating Division—L. D. Mercer,** assistant manager sheet sales, **Republic Steel Corp.,** Cleveland; **R. L. McGean,** vice-president, **McGean Chemical Co.,** Cleveland. The names of the Board of Trustees for 1937 as unanimously elected, appear elsewhere.

The Sales Conference on the morning of October 1st was addressed by **Emery L. Lasier** on the subject of the Institute's Educational Bureau. **G. S. Blome** spoke for the Market Research Section of the Bureau. **Herman L. Cook** spoke on Controlling Production. **R. H. Turk,** presented a proposal for the Technical Research Section of which he is chairman. **Earle S. Smith,** addressed the sales conference on Demonstrating for Greater Sales. **H. D. Chase** reported for the Advertising and Sales Promotion Section. **G. R. MacKnight** spoke on Spreading the Gospel of Porcelain Enamel.

At the Institute meeting on October 2nd, president **R. G. Calton** pointed out in his address that it was the job of the American industry constantly to check on the administration of this country's economic system.

Among the new projects undertaken for the coming year were: an annual short course or open forum for enamelers to be sponsored and supervised by the Institute; establishment of a "Porcelain Enamel Week," to be conducted each year in conjunction with the Institute's educational program; a proposal for the establishment of an all-

porcelain enameled kitchen, and the adoption of a resolution to invite members of the Institute of Vitreous Enamelers of England to meet with enamelers in this country, at the proposed enamelers' forum next year. **G. F. Taubeneck** spoke on What the Rest of the World Thinks about Porcelain Enamel. Practical Problems under the Robinson-Patman Act were discussed by **Rudolph W. Staud** and **E. A. Gross.**

The following individuals were elected to the Board of Trustees of the Porcelain Enamel Institute for 1937, in addition to the officers, with the exception of the secretary and the Executive Committee:

O. Hommel, president, **O. Hommel & Co., Inc.,** Pittsburgh, Pa.; **M. N. Hurd,** president, **Ingram-Richardson Mfg. Co.,** Frankfort, Ind.; **E. H. Weil,** president, **Vitreous Steel Products Co.,** Cleveland, Ohio; **F. S. Davidson,** president, **Davidson Enamel Products Inc.,** Lima, Ohio; **W. A. Donald, Vesco Sales Corp.,** New York City; **Gustav Oesterle,** president, **U. S. Porcelain Enamel Co.,** Los Angeles, Calif.; **J. T. Penton, California Metal Enameling Co.,** Los Angeles, Calif.; **M. J. Saltzman,** president, **Porcelain Metals, Inc.,** Long Island City, N. Y.; **H. H. Wineburgh,** president, **Texlite, Inc.,** New York City; **Bennett Chapple,** vice-president, **American Rolling Mill Co.,** Middletown, Ohio; **F. S. Corrigan,** vice-president, **General Steel Wares, Ltd.,** Toronto, Ont., and **W. L. Lawson,** vice-president, **Harshaw Chemical Co.,** Cleveland, Ohio.

National Electrical Manufacturers Association

Electric Welding Section
Frick Building, Pittsburgh, Pa.

Realizing the need for cooperative development of the industrial applications of the electric welding process, the Electric Welding Section of the National Electrical Manufacturers Association has established development headquarters in the Frick Building, Pittsburgh, Pa. The welding section has intiated a program of cooperative industry development to investigate the electric welding market and determine the possibilities of extending it. In this program especial attention will be given to application engineering, including (1) the preparation of reliable information on cost savings through the use of electric welding, (2) the preparation of material for the use of and cooperation with construction engineers, designers and architects, and (3) the direct promotion of electric welding by missionary work on important new or undeveloped applications. It has been conservatively estimated that by securing the widest possible adoption of applications which have been definitely successful, the use of electric welding in the metal fabricating industries can be increased at least four fold. **H. S. Card,** formerly editor of The Welding Engineer and author of "The Welding Industry," has been appointed Development Director of the N.E.M.A. Electric Welding Section and will be in charge of the Pittsburgh office effective October 1st.

American Welding Society

29 W. 39th St., New York

A series of ten lectures on the Fundamentals of Welding has been arranged to be held at the Polytechnic Institute of Brooklyn, 299 Livingston St., Brooklyn, N. Y. These lectures will be given weekly beginning November 10th. Each lecturer is a recognized authority in his field and the course will be in sufficient detail to be of practical use to those who are actually engaged in welding operations.

Full information can be obtained from the American Welding Society.

International Acetylene Association

30 East 42nd Street, New York

Outstanding leaders in the welding industry are to appear on the Program of the 37th Annual Convention of the International Acetylene Association according to the announcement just made by the Secretary of the Association. The Meeting is to be held this year at the Hotel Jefferson in St. Louis on November 18th, 19th and 20th.

The Program includes meetings which will be of interest to everyone in the welding industry and to all who use welding or cutting. Three Technical Sessions are to be held on the afternoons with two special night programs scheduled for Wednesday and Thursday evenings.

Among the papers related to nonferrous metals, the following will be presented:

Welding of Cupro-Nickels and Silicon Copper Alloys by **I. T. Hook,** Engineer, American Brass Company, Waterbury, Conn.

How Design for Welding Defers Obsolescence and Increases Profits for Manufacturers and Users of Metal Products, by **Erik Oberg,** Editor, Machinery, New York.

Non-Ferrous Metals and Their Welding Characteristics. A subject to be discussed at the Round Table.

Personals

Harold J. Roast

Harold J. Roast, Vice Chairman of the Canadian Section of American Foundrymen's Association, is well known for his excellent work in the Non-Ferrous Division. In recognition of his service, Mr. Roast has been elected to the vice chairmanship.

Mr. Roast was born in London, England, in 1882. He received his education at Henry VIII Foundation, Berkhampstead, England, and is a graduate

HAROLD J. ROAST

of City of London College. He came to Quebec in 1902 and became chemist for the Milton-Hersey Co., Montreal. In 1903, he became associated with the Canada Iron Foundries, Radnor Forges, Que., as chemist in charge. In 1904, he was associated with Dr. J. T. Donald as works manager, Canadian Carbonate Co., Ltd., Montreal, leaving that company to become general manager, Canadian Magnesite Co., Montreal and Newark, N. J., in 1907. In 1914 he left that company to become manager of the testing department, The James Robertson Co., Ltd., Montreal. The National Bronze Co., Ltd., Montreal, claimed his services in 1922 as vice president and general manager. He became president of the company in 1926 and sold the company to Robert Mitchell Co., Ltd., in 1928. Mr. Roast was retained by that company as metallurgical director until 1933 when he became associated with the Canadian Bronze Co., Ltd., as metallurgical advisor. Recently he was elected vice president of that company. In addition to his connection with the Canadian Bronze Co., Ltd., Mr. Roast is proprietor of Roast Laboratories, Montreal.

Mr. Roast has many interests. In addition to his other duties, he is sessional lecturer, department of metallurgy, McGill University, is a professional member of the A.I.M.E., vice president of the Association of Professional Chemists of Quebec, member of the Canadian Institute of Chemistry, Fellow, Chemical Society of London, England; Fellow, Canadian Institute of Chemistry; member, Engineering Institute of Canada; member, A.S.T.M.; Fellow, Sigma XI Society, McGill Chapter.

William A. Harshaw has resigned as president of the **Harshaw Chemical Co.,** Cleveland, Ohio, and has been elected chairman of the board. **William J. Harshaw,** vice-president in charge of production has been elected president. He is a son of the new chairman of the board.

E. **C. Bullard,** vice-president and general manager of **The Bullard Co.,** Bridgeport, Conn., sailed on October 1st for an extended business trip throughout Europe. He will visit

E. C. BULLARD

Sweden, Russia, Germany, France, England and other countries if conditions abroad permit. Present plans indicate that **Mr. Bullard** will return sometime about the middle of December.

W. J. Holtmeier, whose appointment as Eastern Manager for the Hammond Machinery Builders, Inc., Kalamazoo, Mich., was announced in our October issue, will make his headquarters at 148

W. J. HOLTMEIER

W. 23rd St., New York. His practical experience in this field qualifies him to render valuable aid to those contemplating the modernization of their grinding and polishing departments.

E. N. Beisheim has resigned from the sales staff of the Bunting Brass and Bronze Co., Toledo, Ohio.

William F. Wise is now president of the **Republic Products Corp.,** 441 York St., Detroit, Mich. Mr. Wise was for the past nine years general sales manager of **Ex-Cell-O Aircraft and Tool Corp.,** Detroit. **R. B. Criddle,** formerly sales manager of the machinery division of **Ex-Cell-O** is secretary-treasurer of **Republic Products.** The new firm, which was incorporated on September 1, will manufacture precision parts for aircraft engines, refrigerator compressor units and automobiles, besides small special tools, punches and so-called tool details. The firm will operate the following departments: tool room, grinding, polishing and buffing.

Dr. Harold K. Work has been appointed director of research to head the Research and Development Dept. of Jones & Laughlin Steel Corp., Pittsburgh, Pa. In addition to directing the present research staff, Dr. Work will have charge of the new miniature steel plant designed to correlate the work of the research and development engineers with the manufacturing operations. Before coming to J. & L., **Dr. Work** was with the **Aluminum Co. of America,** having started in their research department in 1929 at their Buffalo, N. Y., plant.

H. M. Hobart, consulting engineer, General Electric Co., Schenectady, N. Y., was awarded the Samuel Wylie Miller Memorial Medal of the American Welding Society, at the annual meeting in Cleveland, Ohio, held in connection with the National Metal Congress. Mr. Hobart has been for years one of the outstanding figures in the development of welding methods. He is chairman of the Fundamental Welding Research Committee of the Engineering Foundation, which is directing more than sixty welding researches in university laboratories.

A testimonial dinner was tendered to **Albert Frankel,** formerly Treasurer of Roessler and Hasslacher and later New York Office Manager of the R. & H. Chemicals Department, E. I. duPont de Nemours & Co., at the Blue Ribbon Restaurant, 145 W. 44th St., New York City, on Thursday, October 29th at 6 P. M. Mr. Frankel retired October 31st after 45 years of service with the company.

Obituaries

William A. Jack

William A. Jack, Grand Rapids, Mich., industrialist, a man whose philanthropy and whose interest in civic affairs have left a lasting mark in that city, died unexpectedly recently at his home, 301 College Ave., S.E. Mr. Jack, organizer of one of the city's most prominent industries, the American Box Board Company, was vice-president of the Grand Rapid Brass Co., at the time of his death. His gifts to charitable organizations and his interest in their work made him one of their staunchest supporters in Grand Rapids.

A. J. Smith

A. J. Smith, 63, founder and former president of the American Enamel Products Co., Grand Rapids, Mich., died recently after a long illness. Mr. Smith came to Mt. Pleasant ten years ago to open the enamel factory. Previously he had engaged in a similar business in Chicago. His widow and two children survive.

John Gribbel

John Gribbel, president, American Meter Co., Philadelphia, Pa., died August 28th.

Robert W. Ellingham

Robert W. Ellingham, 68, works manager, Stevens-Waldron Co., Worcester, Mass., hardware manufacturers, died August 22nd. He was a founder of the Indian Motorcycle Co.

William H. Lewis

William H. Lewis, former superintendent and general manager of the National Conduit and Cable Co., Hastings-on-Hudson, N. Y., died suddenly of a heart attack September 27 at his home. He was descended from early English and Dutch settlers. His age was 72.

Born in Philadelphia, Mr. Lewis came to Yonkers in 1888 and that year became superintendent and general manager of the conduit and cable concern, holding that post for thirty years.

Surviving are his widow, Mrs. Esther Conover Lewis, and four sons.

Sherard Osborn Cowper-Coles

Sherard Osborn Cowper-Coles, inventor of the sherardizing process of galvanizing iron, died at Sunbury-on-Thames, England, on Sept. 9, in his with the electrodeposition of metals. most of his life to problems connected with the electrodeposition of metals. He invented a number of electrolytic processes for making, among other uses, iron and copper tubes and sheets, for the recovery of zinc from its ores, and for aluminum welding without a flux.

Mr. Cowper-Coles was a member of the Institution of Electrical Engineers, the American Institute of Electrical Engineers, the Iron and Steel Institute, and the American Electrochemical Society. He was a founder of the Faraday Society, and contributed many valuable technical papers to the institutions of which he was a member. At the Franco-British Exposition of 1908 he was awarded the Grand Prix for electrochemistry.

James L. Shannon

James L. Shannon, president and founder of the James L. Shannon Mfg. Company, Brightwood, Mass., died October 7 in the Springfield, Mass. Hospital, after a brief illness. He was 58 years old.

Mr. Shannon was born in Westville, N. Y. He came to Springfield as a young man and for a number of years was employed at the Springfield Elevator and Pump Co., where he eventually became one of the plant executives. Mr. Shannon's business career included the posts of treasurer and manager of the Bay State Elevator Co. and president, Blake Mfg. Co., Brightwood. Early in 1934, Mr. Shannon established the James L. Shannon Mfg. Co., making brass materials.

John Campbell

John Campbell, 63, president of the Campbell Foundry Co., Harrison, N. J., died August 10 at South Orange, N. J. He founded the above company in 1923. Mr. Campbell, who was born in Scotland, joined the Maher & Flockhart Co., later the Flockhart Foundry Co., in 1892, becoming secretary of the company, and was for many years active as secretary of the old Newark Foundrymen's Association. He was a leading figure in the machinery and foundry industry, and a director of McKiernan & Terry Corp., New York.

Metal Developments

Die cast magnesium alloy is used for the new Hoover One Fifty vacuum cleaner, designed by Henry Dreyfuss for the Hoover Company, No. Canton, Ohio. This, it is claimed, is the first time that magnesium has been used in a household product.

Monel metal is being used to re-roof two sections of the Metropolitan Museum of Art, according to a statement by **R. J. McKay,** research metallurgist of the International Nickel Company, 67 Wall Street, N. Y. About 110,000 pounds of Monel sheet will be consumed.

The **British Industries Fair** for 1937 will be held in London and Birmingham from February 15 to 28th. Among the trade sections to be accommodated are jewelry, silver and plate, and a wide variety of metal products.

The trawler, **"Storm,"** belonging to the Bay State Fisheries, Inc., is a vessel built by the Bath Iron Works of Bath, Maine. It is made entirely of steel fastened by both welding and riveting. **Nickel,** however, plays a very important part in its construction as the hold is made of nickel-steel which, with the refrigeration ducts permits the maintenance of the temperature between 32 and 35° F. at all times, and reduces the ice needs of the operators by 100,000 pounds, adding to the fish carrying capacity by that amount.

The Japanese are advocating the use of **tantalum** as a substitute for platinum in the artificial silk industry, where platinum has been used extensively in rayon spinnerets, according to a report from the Fansteel Metallurgical Corporation, North Chicago, Ill.

Chromium Patent Suit Re-Hearing

United Chromium, Inc., 51 E. 42nd St., New York, filed a petition for a rehearing and re-argument of the case of United Chromium Inc., vs. General Motors et al on October 26, 1936. The United States Circuit Court of Appeals for the Second Circuit granted this petition. The case will be re-argued.

Corporation Earnings

Net Profit Unless Followed by (L) Which is Loss

	1936	1935
Aluminum Industries, Inc. (6 mos.)	$48,468	$34,994
American Smelting & Refining Co. (6 mos. ended June 30)	7,807,528	5,062,850
Anaconda Wire and Cable Co. (3rd quarter)	764,266	213,095
Bohn Aluminum & Brass Corp. (9 mos.)	1,001,535	1,101,563
Bridgeport Brass Co. (9 mos.)	658,806	480,692
Cleveland Graphite Bronze Co. (9 mos.)	932,832	1,039,515
Doehler Die Casting Co. (9 mos.)	710,522	499,345
Federal Mogul Corp. (9 mos.)	329,010	127,617
General Cable Corp. (3rd quarter)	405,365	18,750
General Electric Co. (9 mos.)	26,533,667	17,205,332
International Silver Co. (3rd quarter)	119,972	19,388 (L)
Mueller Brass Co. (9 mos. ended Aug. 31)	5,177,923	3,687,914
Parker Rust-Proof Co. (9 mos.)	868,399	786,074
Reynolds Metals Co. (9 mos.)	1,557,773	738,491
Savage Arms Corp. (3rd quarter)	129,056	55,016
Yale & Towne Mfg. Co. (9 mos.)	675,454	169,163

Business Items-Verified

General Bronze Corporation, Long Island City, N. Y., directorate has been increased to seven members from five and **Charles B. Wiggin** and **Grosvenor Farwell** were elected to fill the vacancies. The board also appointed a management proxy committee to act at special meeting of stockholders, the proxy committee consisting of **H. C. Richard,** chairman of the board, **B. Winthrop** and **C. B. Wiggin.**

Beers Alloys and Chemical Co. Inc., Brooklyn, N. Y., has been organized by **Robert E. Beers,** president and treasurer and **Rudolf W. Deimel,** vice-president and secretary. The company will specialize in nickel, Monel and nickel silver scrap, nickel and nickel chrome alloys, oxides, chemicals, etc., ferrous and non-ferrous material containing nickel in any form. The office and warehouse are located in the Bush Terminal Building No. 1—37th Street and 2nd Ave., Brooklyn.

Groov-Pin Corp., has moved to larger quarters, factory and office, at 411-413 Kerrigan Ave., Union City, N. J. This firm operates the following departments: bronze foundry, tool room, cutting-up shop, zincing (galvanizing), grinding, polishing and buffing.

General Porcelain Enameling Co., 4101 Parker Ave., Chicago, Ill., has let general contract for a two-story enameling plant, 100 x 125 ft., on W. Schubert Ave. Cost over $65,000 with equipment. This firm operates the following departments: metal spraying, enameling, metal cleaning and pickling.

National Brass Co., 1609 Madison Ave., S. E., Grand Rapids, Mich., is adding about 5,000 sq. ft. of floor space, which will make the total floor space about 55,000 sq. ft. The following departments are operated: brass machine shop, tool room, stamping, polishing and buffing, electroplating and lacquering.

Ruud Mfg. Co., Kalamazoo, Mich., manufacturer of water heaters and parts, has purchased for expansion, plant and property formerly occupied by Kalamazoo Sanitary Mfg. Co. Main offices of company are at 2934 Smallman St., Pittsburgh. The following departments are operated: brass machine shop, tool room, stamping, soldering, brazing, metal spraying, grinding, polishing and buffing, electroplating and japanning.

Wells Ignition Mfg. Co., Fond du Lac, Wisc., manufacturers of automotive electrical products, have acquired the plant of the former Gurney Refrigerator Co., at Brooke and Division Sts., and will occupy a substantial part of it at once, for increased capacity. Some new production equipment will be purchased. This firm operates the following departments: tool room, stamping, soldering, metal spraying, grinding and lacquering.

Michaels Art Bronze Co., 231 Court

St., Covington, Ky., has signed a contract with the Great Lakes Construction Co. of Chicago, to supply the bronze, aluminum and ornamental iron to be used in the new downtown Cincinnati post office. Announcement of the contract at a price of $175,000 was made by **F. L. Michaels,** president of the Covington company. This firm operates the following departments: bronze, brass and aluminum foundry; brass machine shop, tool room, casting shop, cutting-up shop, spinning, stamping, soldering, brazing, grinding, polishing and buffing, electroplating, lacquering and japanning.

Application for a permit to sell $300,000 of six per cent preferred stock tor refinancing and expansion purposes has been filed by **The Trane Company** of La Crosse with the Wisconsin Public Service Commission. The new stock issue will increase the authorized capitalization of the company to $1,100,000. **Rebuen N. Trane** is president of the company, which manufactures heating and air conditioning equipment.

The **Linde Air Products Company,** unit of Union Carbide and Carbon Corporation, announces the opening of a new District Office at 2 Virginia Street, Charleston, West Virginia, effective October 5th. **A. R. O'Neal** has been appointed District Manager.

The **Bristol Company** announces the appointment of four graduate engineers to its Field Service organization. These men have just completed a two month training course at the factory at Waterbury, Conn., under the supervision of **F. A. Faust,** Sales Research Engineer and **G. T. Evans,** General Staff Engineer, **E. H. Hart,** Service Engineer, assigned to the Boston Office, Consolidated Building. **J. N. Swarr,** Service Engineer, assigned to the company's New York Office, 220 East 42nd Street to replace **G. T. Evans** who has been promoted to the engineering department at Waterbury. **K. J. Platt,** Service Engineer, assigned to the Philadelphia Office, Market Street National Bank Building. **R. A. Barnes,** Service Engineer, assigned to the company's St. Louis Office, Boatmen's Bank Building.

The name of the firm **Weisberg & Greenwald, Inc.,** 71 W. 45th St., New York, has been changed to **Louis Weisberg, Inc.** This change in the corporate name has been made in view of the fact that **Willard F. Greenwald** is no longer connected with the firm. The business is being continued as before under the direction of **Dr. Louis Weisberg.**

Harry C. Armin, 754 E. 23rd St., Brooklyn, N. Y., has taken over the representation for the Fisher Furnace Co., Chicago, Ill., covering part of New York and New England.

Rudolph Wurlitzer Co., No. Tonawanda, N. Y., for the purpose of simplifying their corporate structure, have decided to eliminate several of their subsidiary companies. Accordingly, the **Rudolph Wurlitzer Mfg. Co.,** a New York corporation, has been liquidated and is to be dissolved, and all of its assets have been transferred to, and the liabilities have been assumed by the **Rudolph Wurlitzer Mfg. Co.,** as of October 2, 1936.

The **Alsop Engineering Corporation** has moved to a new factory in Milldale, Conn., but is retaining offices, showrooms and a service department in New York at 17 West 60th Street. The manufacturers of "Hy-Speed" electric mixers, filters, and filtering materials, bottle fillers, screw cappers, labelers, glass lined tanks, etc., formerly were located at 39 West 60th Street, New York, where they occupied about 25,000 square feet of space. The need for more space, better shipping facilities and a more efficient manufacturing layout, due to a greatly increased business, made a move of this kind absolutely necessary. The new plant is on a plot of 10½ acres, and the buildings cover about 60,000 square feet.

The **Trico Fuse Mfg. Co.,** of Milwaukee, Wis., claiming infringement on U. S. Letters Patent covering clamps for fuse clips has instituted suit through the U. S. District Court at Chicago, against the **Ideal Commutator Dresser Co.,** of Sycamore, Ill. Injunction and damages are being sought.

The **Turner Brass Works,** Sycamore, Ill., announce an important expansion program. **John Slezak,** vice-president, states the company has acquired a 143 by 102 foot brick building to its main plant and has re-equipped it for office space and product development laboratories at a cost of more than $40,000. Office headquarters at the plant have been cramped for the past year and a half and more space was needed, he said.

Foster D. Snell, Inc. announce the opening of their Baltimore branch at 215 N. Calvert Street, Baltimore, Md. Both office and laboratory are located at this address. For the present this branch will be under the direction of **Theodore M. Miller.**

Crowe Name Plate & Manufacturing Company, 1749 Grace Street, Chicago, is building a two-story addition to their present plant, size of addition 107 x 149 feet, for use as office and additional factory space. The company manufactures decorative metal parts, dials, refrigerator interior doors, panels, nameplates, radio control units and escutcheons.

The **McAleer Mfg. Company,** announce the removal of their offices and factory to 2431-39 Scotten Avenue, Detroit, Mich.

Edwards Home-mobile Co., has established a plant in South Bend, Ind., exclusively for the production of house trailers. Officers of the company are **Paul Castner,** general sales manager; chief engineer, **Ralph H. Wise;** production manager, **F. A. Hurcomb;** purchasing agent, **E. A. Somers.**

J. B. McCarthy, vice-president of the **Phillips Electrical Works,** Brockville, Ont., Can., announces that plans and specifications have been drawn up for the construction of two additional buildings at the Brockville plant. Construction work will be started at an early date, and it is anticipated that both structures will be completed and ready for occupancy by the first of November. The new buildings will involve an expenditure of approximately $200,000.

General Fireproofing Co., Youngstown, Ohio, manufacturer of steel and aluminum office furniture and equipment, has recently completed erection of a one-story addition to plant. Cost about $100,000, of which approximately one-half represents equipment. The following departments are operated for the company's own use: tool room, polishing and buffing enameling.

Kelvinator Corp., Detroit, Mich., has announced complete plans for a $600,000 plant expansion program for the manufacture of electric refrigerators. This will consist of two new buildings with a total floor space of 304,000 sq. ft.

A.F.E.L. Metal Products, Inc., Orlando, Fla., have been organized by N. M. Bullock and P. A. Beckett. They manufacture Silve-Lstr, a new alloy, non-rusting, non-corrosive. This alloy is used to coat steel, iron, cast iron, copper, brass, etc. They expect to use a rotary furnace for melting their metal at about 400 to 460 deg. F. They also need pickling equipment and materials handling equipment.

Marveon Displays, Inc., 604-8 Dewar Drive, Rock Springs, Wyo., are planning to install a plating outfit in their manufacturing plant. They are interested in getting the details regarding the necessary equipment, cost, etc.

Magnesol Co., 555 South Flower St., Los Angeles, Cal., manufacturer of industrial chemical products, affiliated with Western Clay & Metals Co., same address, has begun superstructure for initial unit of new plant at South Charleston, W. Va., 60 x 200 ft., to be followed soon by another unit similar in size. Entire project will cost about $100,000 with equipment. It will adjoin plant of Westvaco Chlorine Products Co., which will furnish certain materials for Magnesol works.

Valley Bronze & Machine Works, formerly of Valley Junction, Iowa, has leased a factory building in Webster City, and will install equipment. **Howard A.** and **George Wilhelm** are the proprietors of the company, which operates

a jobbing foundry, making brass, bronze, aluminum and iron castings.

E. F. Feely, South American representative of The International Nickel Co., 67 Wall St., New York, in South America and **J. S. Vanick,** member of the Development and Research Division, will visit several South American countries within the next few months in order to offer consultation service to industrial executives and engineers on problems involved in the production and application of nickel alloys. Their itinerary will include Brazil, Argentina and Chile.

R. C. Stanley, president of the International Nickel Co. of Canada, Ltd., 67 Wall St., New York, announces the formal opening of the company's new research and development laboratory at Birmingham, England. This laboratory has been constructed at a cost of approximately $150,000.

News From Metal Industry Correspondents

New England States

Waterbury, Conn.

October 23, 1936.

Employment in September in all local plants employing 65 or more was 34,519, an increase of 1,373 over August and an increase of 3,525 over the same month last year. In April, 1933, there were only 23,021 employed.

The **Chase Companies, Inc.,** have changed their name to the **Chase Brass & Copper Co.** by amendment to their certificate of incorporation. Hitherto the latter name has been applied to the company's selling organization only. The **Chase** concern plans to build a storage and shipping plant at the **Chase Metals Works** in Waterville, 460 by 60 feet.

The **Hoffman Specialty Co.** of this city, manufacturers of valves, have leased factory space in Stamford and will establish a research laboratory to develop a special line of steam speciates, chiefly controls for air conditioning equipment.

Since the Mayor requested factory heads two months ago to do their hiring from city welfare lists as much as possible, over 100 have been given such jobs, city officials report. The **Chase Metal Works** estimate that they have taken nearly 50 from the rolls and the **Scovill Mfg. Co.** have taken nearly the same number. Officials of all the plants say they are cooperating with the city in this respect as much as possible.

A loan of $400,000 from the Federal Reserve Bank has been obtained by the **Waterbury Clock Co.** and will be used to convert outstanding loans, some outstanding since 1929.

The **Lux Clock Co.** last month declared a 100 per cent stock dividend, thus increasing its stated capital from $300,000 to $600,000. The company is now building an addition which will increase production facilities by 30 per cent.

The **Scovill Mfg. Co., Chase Brass & Copper Co.** and **American Brass Co.** are on hour and wage schedules to conform to the requirements of the Walsh-Healey act which went into effect last month, the local officials say. The law provides that government contracts may be let only to concerns meeting these requirements.

A class in the chemistry of electroplating, sponsored by the **American Electro-Platers' Society** is being held each Thursday evening in Crosby high school. **George Muscio,** a graduate of Sheffield and now employed by the **Lea Mfg. Co.,** and **Herbert T. Baurer,** an instructor in the local WPA college, are in charge of the class.—**W. R. B.**

Connecticut Notes

October 23, 1936.

NEW BRITAIN — The **Stanley Works** are planning the construction of 50 new homes soon with the possibility of erecting another 50 later on. They will be built on land now owned by the concern and will sell for about $5,500. The houses will be offered to employees on easy terms. The city is experiencing a shortage of homes for the first time in 15 years.

BRIDGEPORT — The **Remington Arms Co.** stockholders have approved a change in the capital whereby 7 per cent preferred stock will be replaced by 6 per cent preferred and the number of authorized shares of common stock was increased from 3,400,000 to 7,000,000.

Bodine Corp. of this city has purchased the former Springfield Mfg. Co. plant here where it will manufacture tapping machinery.

ANSONIA—Farrel-Birmingham Co. announces the resignation of Vice-President **Franklin R. Hoadley** who has been elected president of the **Atwood Machine Co.** of Stonington.

The **Ansonia Mfg. Co.** has announced a wage increase of 5 per cent.

NORWALK—The **Segal Lock Co.** are planning an addition to meet increased production requirements. They report that sales have been increasing in recent months.—**W. R. B.**

Providence, R. I.

October 23, 1936.

There has been a marked improvement in all lines of the metal trades, especially in the various branches of the manufacturing jewelry industry where the conditions are the best they have been since 1928. Building trades have shown a decided uplift and in the tool and machinery branches the gain has been satisfactory. But best of all is the fact of the very encouraging outlook along the entire line of a reasonable continuance of improving conditions. These indicatives include more operatives employed, increased payrolls, greater consumption of power and more and larger orders.

The regular monthly meeting of the **Metal Finding Manufacturers' Association** was held at the Narragansett Hotel on Wednesday, October 7 with President **Edgar E. Baker** presiding, when various matters pertaining to the association were subject of general discussion. Regulations for making payments in connection with the Federal and State Social Security plans were discussed by President Baker and there was consideration of methods of curbing price cutting. **William G. Lind** of the Tercentenary Committee reported upon the success and part played by the association in the recent Rhode Island Industrial Exposition at the State Armory.

The **Electric Wire & Assembly Corporation,** of Pawtucket, has been incorporated under the laws of Rhode Island with an authorized capital consisting of 500 shares of common stock of no par value. The incorporators are given as **A. J. Dunn** of Providence and **M. R. Russell** and **John H. Smith** of Pawtucket.

According to a preliminary report which is subject to revision, made public a few days ago by **William L. Austin,** Director of the Bureau of Census, United States Department of Commerce, both production and employment in the manufacture of jewelry in Rhode Island in 1935 showed pronounced increases over 1933. The number of wage earners reported for 1935 reached an average total for the year of 6,300 an increase of 29 per cent over the total of 4,884 in 1933 but a decrease of 38.7 per cent from the 10,273 total in 1929.

The **Jewel-Craft, Inc.** of Providence, that was incorporated in September under the laws of Rhode Island, has changed its name to the **Crescent Jewelry Company.**

The **Rhode Island School of Design** at Providence has established this fall a class in electroplating in connection with the jewelry and silversmithing department. It will be in charge of **Joseph A. Smith,** of **Baker & Company,** of Newark, N. J. as instructor. Mr. Smith is a practical man with several years experience in electroplating and the new class will be a welcome addition to the other classes which have already been established in this department of the institution.

The building of an addition to the plant of the **General Plate Company,** on Forest Street, Attleboro, is well under way, to take care of the large increase

in the concern's business. It will cost approximately $10,000.

The **Paramount Plating Company,** 36 Garnet Street, Providence, has filed a statement at the Secretary of State's office of the change of name to the **City Plating Company.**—**W. H. M.**

Middle Atlantic States

Utica, N. Y.

October 23, 1936.

Employment in Utica's four major industries reached the highest level in September since March, 1930, according to the report of the Industrial Association of Utica.

The figures show 98.1 per cent of normal for employment and 94.9 per cent of normal for working hours. The percentages are for the blended figures for foundry, metal trades, textile and clothing groups. The foundry group showed 1.5 per cent gain in employment and 11.7 per cent gain in working hours over August while the metal trades showed 2.2 per cent gain in employment and 2.2 per cent gain in working hours over August.

The president of the **Savage Arms Corporation,** Utica, said business is better with the corporation this fall. In Rome the companies handling brass and copper novelties are reporting a brisk Christmas trade.—**E. K. B.**

Newark, N. J.

October 23, 1936.

The **Admak Manufacturing Co., Inc.,** makers of radio tube parts and metal stampings, Irvington, have purchased a plant at that place which it occupied for the past two years. The building comprises 6,400 square feet of space and 160 feet in length. **Walter S. Becker,** general manager of the **Richardson Co.,** manufacturers of battery boxes, New Brunswick, reports a general improvement in business and says the concern is on the same basis as in 1929. Three shifts are now employed. The employees have been given a wage increase.

The **Walker-Turner Co., Inc.,** makers of tools, has purchased for an annex an adjoining building at Plainfield. The **Electrical Industries Mfg. Co.,** of New York, have leased a factory building at Red Bank for the manufacture of electrical and mechanical devices.

—**C. A. L.**

Trenton, N. J.

October 23, 1936.

Advance in the prices of some chemicals has resulted in manufacturers making purchases before a further increase. The majority of the metal industry concerns report business holding up very well.

The plant of the **Consolidated Chemical Co.,** Monmouth Junction, N. J., formerly the **Miner Edgar Chemical Co.,** has been purchased by the **Magnetic Pigment Co.,** of Trenton. The sale was made through the receiver, **Kenneth Robbie.** The Trenton company is a subsidiary of the **United Carbon Co.,** of New York, one of the largest chemical firms in the country. The plant has been remodeled.

The **Keystone Watch Case Co.,** Riverside, N. J., reports a boom in business with 1,100 hands at work. The metal works are operating with three shifts. The employees were recently granted an increase of 10 per cent in wages.

—**C. A. L.**

Middle West

Detroit, Mich.

October 23, 1936.

The motor car industry is getting into swing again as the 1937 models are meeting with increased sales, and from now on new production records may be expected through the fall and winter season. Automobile parts and accessory companies are keeping pace with the major plants and likewise will make increased production reports.

This new activity is absorbing much skilled labor, but owing to an increase use of machinery, unskilled labor continues to back up, and it is not well for such workers from outside the Detroit industrial area to expect much success in seeking jobs.

The plating plants are rapidly going into production, most of them having orders ahead that will keep them busy for months.

Announcement is made that a third Michigan aircraft manufacturing industry is about to come into existence, supplementing the **Stinson Aircraft Corpn.** in Wayne, and the **Hammond Aircraft** in Ypsilanti. This concern, it is stated, will be established shortly in Mt. Pleasant, and will be known as the Auto Plane Corporation of Mt. Pleasant, with capital of $120,000, all of which has been subscribed. This organization, it is stated, plans to manufacture a "flivver" plane to sell from $1,000 to $1,200. It will be capable of landing and taking off in limited spaces, and may be landed safely either on land or water.

The **Detrola Radio & Television Corpn.,** of Detroit, has acquired additional space opposite its plant on Twenty-sixth Street, to handle its metal stamping and plating departments. This expansion is intended to facilitate production of 1937 models for which there is a greatly increased demand, it is said.

R. W. Geyer, president of the **Grand Rapids Brass Co.,** announces that it has closed a contract with the **Kelvinator Corporation** for all the latter's cabinet hardware in 1937. This amounts to more than $300,000 worth of business, it is stated.

Announcement is made that the **Buick Motor,** division of the **General Motors Corpn.,** has appropriated $14,000,000 to supplement a $15,000,000 expenditure made in expansion and improvements this year at the Flint, Mich., plant. The new construction, together with changeover to 1937 models, involves a complete redesign of the Buick manufacturing layouts, it is stated. Many major changes already have taken place while others will be started from time to time, it is stated.—**F. J. H.**

Pacific States

Los Angeles, Calif.

October 20, 1936.

The **Aero Engineering Corp.,** headed by **James A. Phillips, Jr.,** and backed by the California Institute of Technology of Pasadena, will establish here a factory to make a new "Aeroneer" ship for the air.

The new **Chrysler** motor factory, according to **Charles H. Fennell,** vice president, have added to the assembly and factory processes, a complete enameling, lacquering, polishing, striping and wheel painting equipment.

The **Hylite Corp.,** 255 West Santa Barbara Ave., **G. A. Manning** at the head, are making a new line of electric signs.

The **Kaelin Electric Co.,** 1410 South Los Angeles St., **Henry F. Kaelin,** president, are making a new line of electric power units for household and other purposes, to use direct current power, also for lights and radio.

Gaffers & Sattler, 4561 East 50th St., making gas ranges and heaters, have added new line of electric refrigerators and a special model for hot climates.

The **Federated Metals Corp.** have moved to 2425 Hunter St., making babbit and type metal, solder, ingot brass and other metals, **Seymour Swarts,** manager.

The **Utility Fan & Mfg. Co.,** of 2528 Santa Fe Ave., have enlarged their business so as to make airplane and ventilating fans, refrigerating car coolers, air conditioning equipment, etc.

The **Reliable Novelty & Foundry Co.** have moved to 1123 East 63d St., **Morris Loewen,** president, making cast aluminum kitchen utensils, Dutch ovens, etc.

The **Whip-it-Mixer Co.** at 827 South Spring St., have started making metal whippers and mixers.

Jackway, the lampmaker at 1221 North Vermont St., is now making lamps of metal.

McArthur-Warren Furniture, Ltd., have adopted airplane tubing of aluminum, with electrolytic finish for making furniture, also will use brass, copper tubing, reinforced with steel rods and put together without welding. They will make it for national distribution. They use threaded tubes, rods, nuts, bolts, ferrules, washers, gliders and caps.

The **Merrill-Harper Co.. C. H. Merrill** at the head, 631 6th St., will operate a sheet metal plant for metal specialties

and plumbing lines, **James Harper**, general manager.

The **Pasadena Sprinkler Co.** of Pasadena will make a new line of overhead sprinklers.

The **California Stove Mfg. Co.**, 1446 Weyse St., are making new lines of rural, mountain and camping cook stoves, **L. R. Raymond** at the head.

The **National Metal Racket Co.** is a new concern to make metal tanner's rackets at 4109 South Hoover St. of duralumin.

The **Doorman Mfg. Co.** of 6127 South Western Ave., **Robert A. Casey**, president, will manufacture electric protective door opening appliances.

The **Mototoy Mfg. Co.** have started at 6916 Melrose Ave., **Fred A. McFarland** at the head, to make motorized toy airplanes, with propeller, engine and tank.

The **General Water Heater Corp.**, 1107 North Highland Ave., will enlarge their Burbank factory at Front & Cypress Sts., put in new machine shop.

The **Commercial Refrigerator Co.**, 1020 East 59th St., have invented and started manufacturing an ice cream machine of metal.—**H. S.**

Metal Market Review

October 23, 1936.

Copper was the big question mark of the month. American prices remained unchanged at 9.75c. per pound, electrolytic, delivered Connecticut Valley, but the market was buzzing nevertheless, as the foreign market was consistently higher than the American. Even though copper producers agreed on October 15th to raise their output by 5%, to 85% of capacity, the foreign market continued to rise, going as high on October 22nd as 10.20, C.I.F. The demand is undoubtedly due partly to munitions, but also to a considerable extent to improving industry in England and on the continent.

Late report: on October 26th, domestic copper was raised to 10c. Sales on that day totalled 84,500 tons.

Sales in the United States, week by week, were 7,289 tons, 4,926 tons, 7,783 tons and 18,880 tons, definitely pointing toward a rise in the domestic price. Apparent consumption in the United States is about 75,000 tons a month and abroad about 83,000 tons a month. September statistics showed another reduction in domestic stocks, all pointing in the same direction—a higher price.

Zinc demand was steady and fair throughout most of the past four weeks with the price remaining at the same level, 4.85c. per pound East St. Louis. Sales during this period were 2,000 tons, 7,286 tons, 1,400 tons and about 5,000 tons. The spurt during the last week was influenced by higher prices abroad and substantial buying by galvanizers. Statistics showed a reduction of stocks to 54,000 tons in September, continuing the unvarying trend downward from 68,000 tons in January.

Tin remained fairly steady at levels something over 45c. per pound Straits although buying after the first week was on a somewhat reduced scale because consumers were uncertain about the control plan and the downward trend of Sterling. During the week ending October 21 prices declined slightly to about 44.125, being unsettled by the announcement that the Tin Committee had been unable to make an agreement with Siam. Another meeting will be held on November 5th after which a statement will be made.

Lead had a decidedly bullish air in general although the price did not change from 4.45c. per pound E. St. Louis, with the exception of the St. Joseph Lead Co., who advanced the price to 4.50 during the middle of the month. Other producers, however, had maintained their old figure. The explanation of the firmness came out with the statistics showing a reduction of 17,716 tons during September, bringing the total domestic stocks down to about 200,000 tons, with shipments for September over 50,000 tons. Sales were 5,900 tons, 8,250 tons, 8,300 tons and 14,000 tons. Needless to say the market is firm.

Late report: on October 27th, lead was raised to 4.55c, f.o.b. E. St. Louis, and the 29th, to 4.65.

Silver was "as usual"—quiet. The New York official price was unchanged at 44.75c. per ounce. London prices fluctuated slightly under the influence of the market in Sterling and some speculation in India. According to the American Bureau of Metal Statistics, the United States produced 4,733,000 ounces during August against 4,616,000 in July and 5,293,000 in June, total for the eight months of 1936, 39,201,000 ounces.

Platinum took its not unexpected nose-dive. On September 28 the leading interest reduced the price from $70 to $64 per ounce. This was followed by further reductions down to $50; present price, $50-$53. Speculative interests are said to have been caught with considerable quantities on which they attempted to take a profit, with the inevitable result. The market is still unsettled but much quieter; prospects cloudy.

The **Scrap** metal market has been very much under the influence of the bullish primary market. Intake for September was reported as low because of the reluctance of sellers to act while the pressure was so clearly upward. Export bids for scrap rose and during the week ending October 23rd the margin in favor of export bids was 40 to 50 points on No. 1 and No. 2, and from 75 to 90 points on light copper. Complaints are being heard from American smelters of a shortage of secondary material.

The demand for secondary aluminum was steady and prices were also steady, but aluminum scrap eased perceptibly during the last two weeks. Brass ingot bookings were light to fair. This was not unexpected, however, in view of the fact that unfilled orders were at a high mark.

On October 1, unfilled orders for brass and bronze ingots and billets on the books of the members of the Non-Ferrous Ingot Metal Institute amounted to a total of 23,796 net tons.

The combined deliveries of brass and bronze ingots and billets by the members for the month of September, 1936, amounted to a total of 6,783 tons.

The Institute reports the average prices per pound received by its membership on Commercial Grades of six principal mixtures of Ingot Brass during the twenty-eight day period ending October 2nd.

80-10-10 (1½% Imp.)	11.046c.
78% Metal	8.755c.
81% Metal	9.007c.
83% Metal	9.254c.
85-5-5-5	9.531c.
No. 1 Yellow Brass	7.793c.

The **Wrought Metal Industry** is in better condition than at any time since 1929, and probably fundamentally sounder than it was at that time. Valley mills report operations almost to full capacity. The employment mark for Waterbury is at 98.23% of the 1929 record. Revere Copper and Brass is operating at 70%. It is noteworthy that these high rates of production have been achieved without as yet any great demand from the public utilities, and are expected to come into the market during the next 6 to 12 months. Prospects are decidedly cheerful.

A large metropolitan distributor reports business during October to be about 5% above September and about 25% above October, 1935.

AVERAGE PRICES FOR METALS

	September
Copper c/lb. Duty 4c/lb.	
Lake (del. Conn. Producers' Prices)	9.812
Electrolytic (del. Conn. Producers' Prices)	9.75
Casting (f.o.b. ref.)	9.40
Zinc (f.o.b. E. St. Louis) c/lb. Duty 1¼ c/lb.	
Prime Western (for Brass Special add 0.05)	4.85
Tin (f.o.b. N. Y.) c/lb. Duty Free, Straits	44.738
Lead (f.o.b. St. L.) c/lb. Duty 2⅛ c/lb.	4.450
Aluminum c/lb. Duty 4 c/lb.	20.500
Nickel c/lb. Duty 3 c/lb. Electrolytic 99.9%	35.00
Antimony (Ch. 99%) c/lb. Duty 2c/lb.	12.50
Silver c/oz. Troy, Duty Free	44.750
Platinum $/oz. Troy, Duty Free.	68.548
Gold—Official U. S. Treasury Price $/oz. Troy	35.00

Metal Prices, October 27, 1936

(Import duties and taxes under U. S. Tariff Act of 1930, and Revenue Act of 1932)

NEW METALS

Copper: Lake, 10.125, Electrolytic, 10.00, Casting, 9.70.
Zinc: Prime Western, 4.85. Brass Special, 4.95.
Tin: Straits 44.60.
Lead: 4.55. **Aluminum,** 19-22. **Antimony,** 12.50.
Nickel: Shot, 36. Elec., 35.

Quicksilver: Flasks, 75 lbs., $95. **Bismuth,** $1.00.
Cadmium, 75c to 80c. **Silver,** Troy oz., official price, N. Y., Oct. 27, 44.75c. **Gold:** Oz. Troy, Official U. S. Treasury price, Oct. 27, $35.00. **Scrap Gold,** 6¾c. per pennyweight per karat, dealers' quotation. **Platinum,** oz. Troy, $48.00.

Duties: Copper, 4c lb.; zinc, 1½c. lb.; tin, free, lead, 2½c. lb.; aluminum, 4c lb.; antimony, 2c. lb.; nickel, 3c. lb.; quicksilver, 25c lb.; bismuth, 7½%; cadmium, 15c. lb.; cobalt, free; silver, free; gold, free; platinum, free.

INGOT METALS AND ALLOYS

	Cents lb.	U S. Import Duty	Tax*
No. 1 Yellow Brass	8.25	None	4c. lb.[1]
85-5-5-5	10.00	None	4c. lb.[1]
88-10-2	13.75	None	4c. lb.[1]
80-10-10	11.50	None	4c. lb.[1]
Manganese Bronze (60,000 t. s. min.)	10.25	None	4c. lb.[1]
Aluminum Bronze	14.50	None	4c. lb.[1]
Monel Metal Shot or Block	28	25% a. v.	None
Nickel Silver (12% Ni)	12.00	20% a. v.	4c. lb.[1]
Nickel Silver (15% Ni)	14.25	20% a. v.	4c. lb.[1]
No. 12 Aluminum	16.50-20	4c. lb.	None
Manganese Copper, Grade A (30%)	18-23	25% a. v.	3c. lb.[1]
Phosphor Copper, 10%	12-14	3c. lb.	4c. lb.[1]
Phosphor Copper, 15%	13.25-15	3c. lb.	4c. lb.[1]
Silicon Copper, 10%	18-30	45% a. v.	4c. lb.[1]
Phosphor Tin, no guarantee	49-75	None	None
Iridium Platinum, 5% (Nominal)	$58.00	None	None
Iridium Platinum, 10% (Nominal)	$63.00	None	None

* Duty is under U. S. Tariff Act of 1930; tax under Section 60 (7) of Revenue Act of 1932.
[1] On copper content. [2] On total weight. "a. v." means ad valorem.

OLD METALS

Dealers' buying prices, wholesale quantities:	Cents lb.	Duty	U. S. Import Tax
Heavy copper and wire, mixed	7⅝to 7⅞	Free	4c. per pound on copper content
Light copper	7 to 7¼	Free	
Heavy yellow brass	4½to 4¾	Free	
Light brass	4⅛to 4⅜	Free	
No. 1 composition	6½to 6¾	Free	
Composition turnings	6 to 6¼	Free	
Heavy soft lead	4 to 4⅛	2⅛c.lb.	None
Old zinc	2½to 2⅝	1½c.lb.	
New zinc clips	3½to 3¾	1½c.lb.	
Aluminum clips (new, soft)	13½to14	4c.lb.	
Scrap aluminum, cast	12 to12¼	4c.lb.	
Aluminum borings—turnings	6 to 6¼	4c.lb.	
No. 1 pewter	30 to 31	Free	
Electrotype	4¼to 4⅜	2⅛c.llb.*	
Nickel anodes	24 to 25	10%	
Nickel clips, new	33 to 35	10%	
Monel scrap	8½to 15	10%av.	

* On lead content.

Wrought Metals and Alloys

The following are net BASE PRICES per pound, to which must be added extras for size, shape, quantity, packing, etc., or discounts, as shown in manufacturers' price lists, effective since September 10, 1936. Basic quantities on most rolled or drawn brass and bronze items below are from 2,000 to 5,000 pounds; on nickel silver, from 1,000 to 2,000 pounds.

COPPER MATERIAL

	Net base per lb.	Duty*
Sheet, hot rolled	17½c.	2½c. lb.
Bare wire, soft, less than carloads	13½c.	25% a v.
Seamless tubing	18 c.	7c. lb.

* Each of the above subject to import tax of 4c. lb. in addition to duty, under Revenue Act of 1932.

BRASS AND BRONZE MATERIAL

	Yellow Brass	Red Brass 80%	Comm'l. Bronze	Duty	U. S. Import Tax
Sheet	15⅝c.	16½c.	17⅜	4c. lb.	4c. lb. on copper content.
Wire	15⅞c.	16¾c.	17⅝	25%	
Rod	13⅝c.	16¾c.	17½	4c. lb.	
Angles, channels.	23¾c.	24½c.	25⅛	12c. lb.	
Seamless tubing.	17⅞c.	18½c.	19⅜	8c. lb.	
Open seam tubing	23⅜c.	24½c.	25⅛	20% a.v.	

NICKEL SILVER

Net base prices per lb. (Duty 30% ad valorem.)

Sheet Metal		Wire and Rod	
10% Quality	24⅞c.	10% Quality	27½c.
15% Quality	27 c.	15% Quality	31⅞c.
18% Quality	28¼c.	18% Quality	35⅛c.

TOBIN BRONZE AND MUNTZ METAL

Net base prices per pound. (Duty 4c. lb.; import tax 4c. lb. on copper content.)	
Tobin Bronze Rod	17½c.
Muntz or Yellow Rectangular and other sheathing	18⅞c.
Muntz or Yellow Metal Rod	15 c.

ALUMINUM SHEET AND COIL

(Duty 7c. per lb.)

Aluminum sheet, 18 ga., base, ton lots, per lb.	32.80
Aluminum coils, 24 ga., base price, ton lots, per lb.	30.50

ROLLED NICKEL SHEET AND ROD

(Duty 25% ad valorem, plus 10% if cold worked.)

Net Base Prices

Cold Drawn Rods	49c.	Cold Rolled Sheet	53c.
Hot Rolled Rods	44c.	Standard Sheet	48c.

MONEL METAL SHEET AND ROD

(Duty 25% ad valorem, plus 10% if cold worked.)

Hot Rolled Rods (base)	.34	Standard Sheets (base)	.38
Cold Drawn Rods (base)	.39	Cold Rolled Sheets (base)	.43

SILVER SHEET

Rolled sterling silver (Oct. 27) 47c. per Troy oz. upward according to quantity. (Duty. 65% ad valorem.)

ZINC AND LEAD SHEET

	Cents per lb. Net Base	Duty
Zinc sheet, carload lots, standard sizes and gauges, at mill, less 7 per cent discount	9.50	2c. lb.
Zinc sheet, 1200 lb. lots (jobbers' price)	10.25	2c. lb.
Zinc sheet, 100 lb. lots (jobbers' price)	14.25	2c. lb.
Full Lead Sheet (base price)	8.00	2⅜c. lb.
Cut Lead Sheet (base price)	8.25	2⅜c. lb

BLOCK TIN, PEWTER AND BRITANNIA SHEET

(Duty Free)

This list applies to either block tin or No. 1 Britannia Metal Sheet, No. 23 B. & S. Gauge, 18 inches wide or less; prices are all f. o. b. mill:

500 lbs. over	15c. above N. Y. pig tin price
100 to 500 lbs.	17c. above N. Y. pig tin price
Up to 100 lbs.	25c. above N. Y. pig tin price
Up to 100 lbs.	25c. above N. Y. pig tin price

Supply Prices on page 464.

Supply Prices, October 27, 1936

ANODES

Prices, except silver, are per lb. f.o.b., shipping point, based on purchases of 500 lbs. or more, and subject to changes due to fluctuating metal markets.

Copper: Cast 17¼c. per lb.
Electrolytic, full size, 15½c. cut to size 15½c. per lb.
Rolled oval, straight, 16c.; curved 17 c. per lb.
Brass: Cast 17¾c. per lb.
Zinc: Cast 10⅛c. per lb.
Nickel: 90-92% .45 per lb.
95-97% .46 per lb.
99%+cast, 47c.; rolled, depolarized, 48.
Silver: Rolled silver anodes .999 fine were quoted Oct. 27, from 48c. per Troy ounce upward, depending on quantity.

WHITE SPANISH FELT POLISHING WHEELS

Even Diameters	Thickness	Under 50 lbs.	50 to 100 lbs.	Over 100 lbs.
10-12-14 & 16	1″ to 2″	$2.35/lb.	$2.23/lb.	$2.12/lb.
10-12-14 & 16	2 to 3½	2.35	2.23	2.12
6-8 & 18	1 to 2	2.35	2.23	2.12
6-8 & 18	2 to 3½	2.35	2.23	2.12
Over 18	Under ½	3.80	3.61	3.42
Over 18	½ to 1	3.45	3.28	3.11
Over 18	Over 3½	2.80	2.66	2.52

Odd Diameters

Less than 50 lbs.—add 40c. per lb. to "Even Diameters" list.
50 lbs. or over—all one size and consistency and in one shipment —same as "Even Diameters."

Extras: 25c per lb. on wheels, 1 to 6 in. diam., over 3 in. thick. On grey Mexican wheels deduct 10c. per lb. from above prices.

COTTON BUFFS

Full disc open buffs, per 100 sections when purchased in lots of 100 or less are quoted:

16″ 20 ply 84/92 Unbleached	$71.13
14″ 20 ply 84/92 Unbleached	54.58
12″ 20 ply 84/92 Unbleached	41.09
16″ 20 ply 80/92 Unbleached	59.37
14″ 20 ply 80/92 Unbleached	45.64
12″ 20 ply 80/92 Unbleached	34.45
16″ 20 ply 64/68 Unbleached	51.26
14″ 20 ply 64/68 Unbleached	39.47
12″ 20 ply 64/68 Unbleached	29.86
⅜″ Sewed Buffs, per lb., bleached or unbleached	48c. to 1.12

CHEMICALS

These are manufacturers' quantity prices and based on delivery from New York City.

Acetone C. P.	lb.	.08½-.13½
Acid—Boric (Boracic) granular, 99½+% ton lots	lb.	.05¼-.05¾
Chromic, 400 or 100 lb. drums		.16¾
Hydrochloric (Muriatic) Tech., 20 deg., carboys	lb.	.03
Hydrochloric, C. P., 20 deg., carboys	lb.	.06½
Hydrofluoric, 30%, bbls.	lb.	.07-.08
Nitric, 36 deg., carboys	lb.	.05-.06¼
Nitric, 42 deg., carboys	lb.	.07-.08
Sulphuric, 66 deg., carboys	lb.	.029
Alcohol—Butyl, drums	lb.	.09½-.12
Denatured, drums	gal.	.30-.476
Alum—Lump, barrels	lb.	.03¼-.03½
Powdered, barrels	lb.	.0340-.0365
Ammonia, aqua, com'l., 26 deg., drums, carboys	lb.	.02½-.05
Ammonium—Sulphate, tech., bbls.	lb.	.03½-.05
Sulphocyanide, technical crystals, kegs	lb.	.55-.58
Arsenic, white kegs	lb.	.04½-.05
Asphaltum, powder, kegs	lb.	.23-.41
Benzol, pure, drums	gal.	.41
Borax, granular, 99½+%, ton lots	lb.	.0245-.0295
Cadmium oxide, 50 to 1,000 lbs.	lb.	1.05
Calcium Carbonate (Precipitated Chalk), U. S. P.	lb.	.05¾-.07½
Carbon Bisulphide, drums	lb.	.05½-.06
Chrome, Green, commercial, bbls.	lb.	.21½-.23½
Chromic Sulphate, drums	lb.	.33-.55
Copper—Acetate (Verdigris)	lb.	.23
Carbonate, 53/55% cu., bbls.	lb.	.15½
Cyanide (100 lb. kgs.)	lb.	.38-.40
Sulphate, tech., crystals, bbls.	lb.	.04½-.05
Cream of Tartar Crystals (Potassium Bitartrate)	lb.	.20¼-.20½
Crocus Martis (Iron Oxide) red, tech., kegs	lb.	.07
Dextrin, yellow, kegs	lb.	.05-.08
Emery Flour	lb.	.06½
Flint, powdered	ton	30.00
Fluorspar, bags	lb.	.03½
*Gold Chloride	oz.	$18¼-23
*Gold Cyanide, Potassium		$15.45
*Gold Cyanide, Sodium		$17.10
Gum—Sandarac, prime, bags	lb.	.50
Shellac, various grades and quantities	lb.	.21-.31
Iron Sulphate (Copperas), bbls.	lb.	.016
Lead—Acetate (Sugar of Lead), bbls.	lb.	.10-.13½
Oxide (Litharge), bbls.	lb.	.12½
Lime Compositions for Nickel	lb.	.09½-.11
Lime Compositions for Brass	lb.	.09½-.11
Mercury Bichloride (Corrosive Sublimate)	lb.	$1.58
Methanol, (Wood Alcohol) Pure, drums	gal.	.42½
Nickel—Carbonate, dry, bbls.	lb.	.35-.41
Chloride, bbls.	lb.	.18-.22
Salts, single, 425 lb. bbls.	lb.	.13½-.14½
Salts, double, 425 lb. bbls.	lb.	.13½-.14½
Paraffin	lb.	.05-.06
Phosphorus—Duty free, according to quantity	lb.	.35-.40
Potash Caustic Electrolytic 88-92% broken, drums	lb.	.07¼-.08⅜
Potassium—Bichromate, casks (crystals)	lb.	.09
Carbonate, 96-98%	lb.	.07⅜
Cyanide, 165 lbs. cases, 94-96%	lb.	.57½
Pumice, ground, bbls.	lb.	.02½
Quartz, powdered	ton	$30.00
Rosin, bbls.	lb.	.04½
Sal Ammoniac (Ammonium Chloride) in bbls.	lb.	.05-.07½
*Silver—Chloride, dry, 100 oz. lots	oz.	.38
Cyanide, 100 oz. lots	oz.	.45¾
Nitrate, 100 ounce lots	oz.	.32¾
Soda Ash, 58%, bbls.	lb.	.0252
Sodium—Cyanide, 96 to 98%, 100 lbs.	lb.	.17½-.22
Hyposulphite, kegs, bbls.	lb.	.03½-.06½
Metasilicate, granular, bbls.	lb.	2.55-3.15
Nitrate, tech., bbls.	lb.	.02¼
Phosphate, tribasic, tech., bbls.	lb.	.03
Silicate (Water Glass), bbls.	lb.	.01½
*Stannate, drums	lb.	.30-.33
Sulphocyanide, drums	lb.	.30-.45
Sulphur (Brimstone), bbls.	lb	.02¾
*Tin Chloride, 100 lb. kegs	lb.	.35½
Tripoli, powdered	lb.	.03
Trisodium Phosphate—see Sodium Phosphate.		
Wax—Bees, white, ref. bleached	lb.	.60
Yellow, No. 1	lb.	.45
White Silica Compositions for Brass	lb.	.07½-.10
Whiting, Bolted	lb.	.02½-.06
Zinc—Carbonate, bbls.	lb.	.11-.12
Cyanide (100 lb. kegs)	lb.	.37-.38
Chloride, drums, bbls.	lb.	.06
Sulphate, bbls.	lb.	.033

*Subject to fluctuations in metal prices.